

Beckman®

NIAA 430568

INSTRUCTION MANUAL

POWER SUPPLY

For 546-H

DU Spectrophotometers

MP MASTER



MA34167



Beckman®

Scientific Instruments

INSTRUCTION MANUAL

POWER SUPPLY

For **546-H**

DU Spectrophotometers

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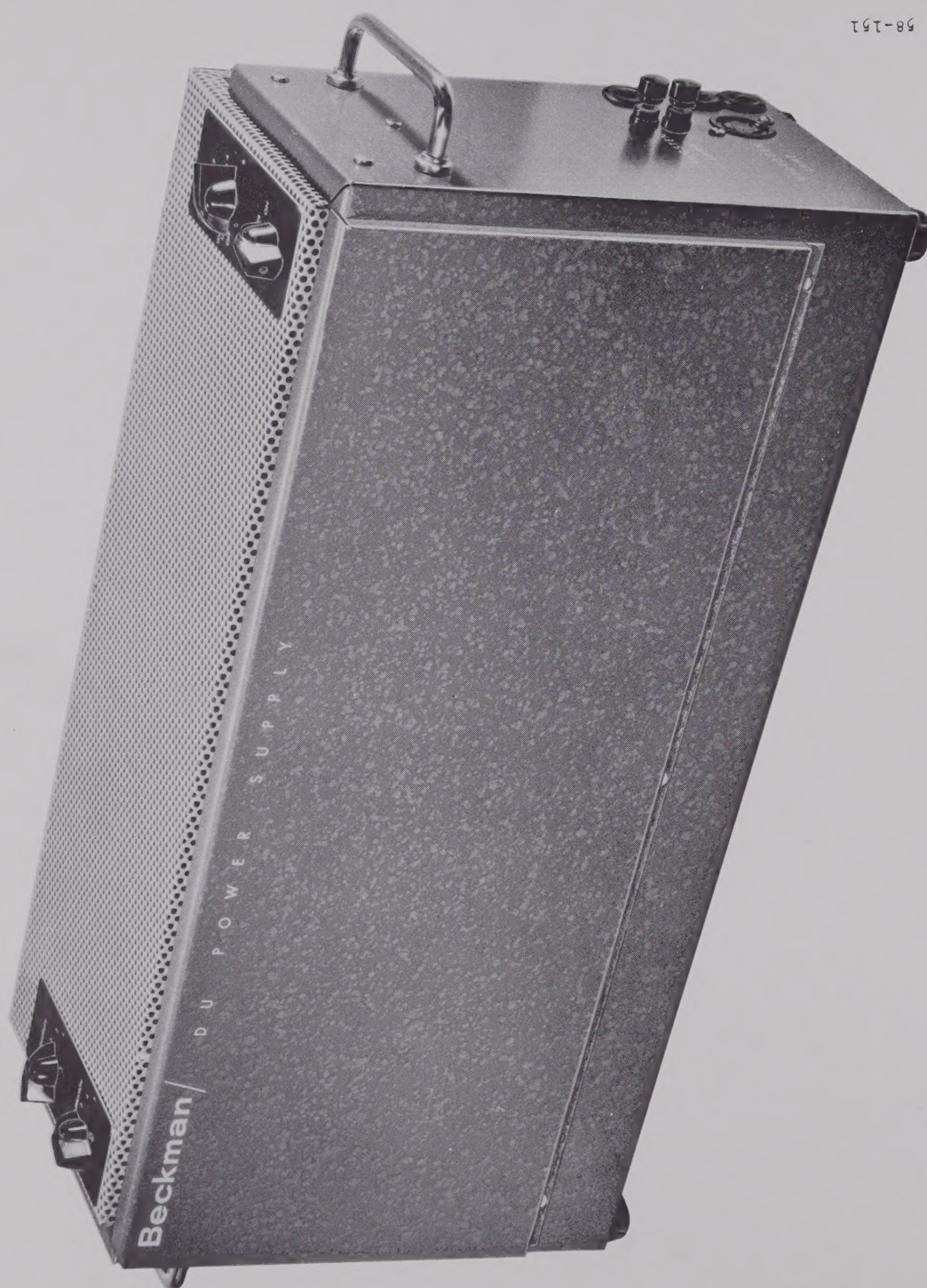


FIGURE 1. DU POWER SUPPLY

SECTION 1

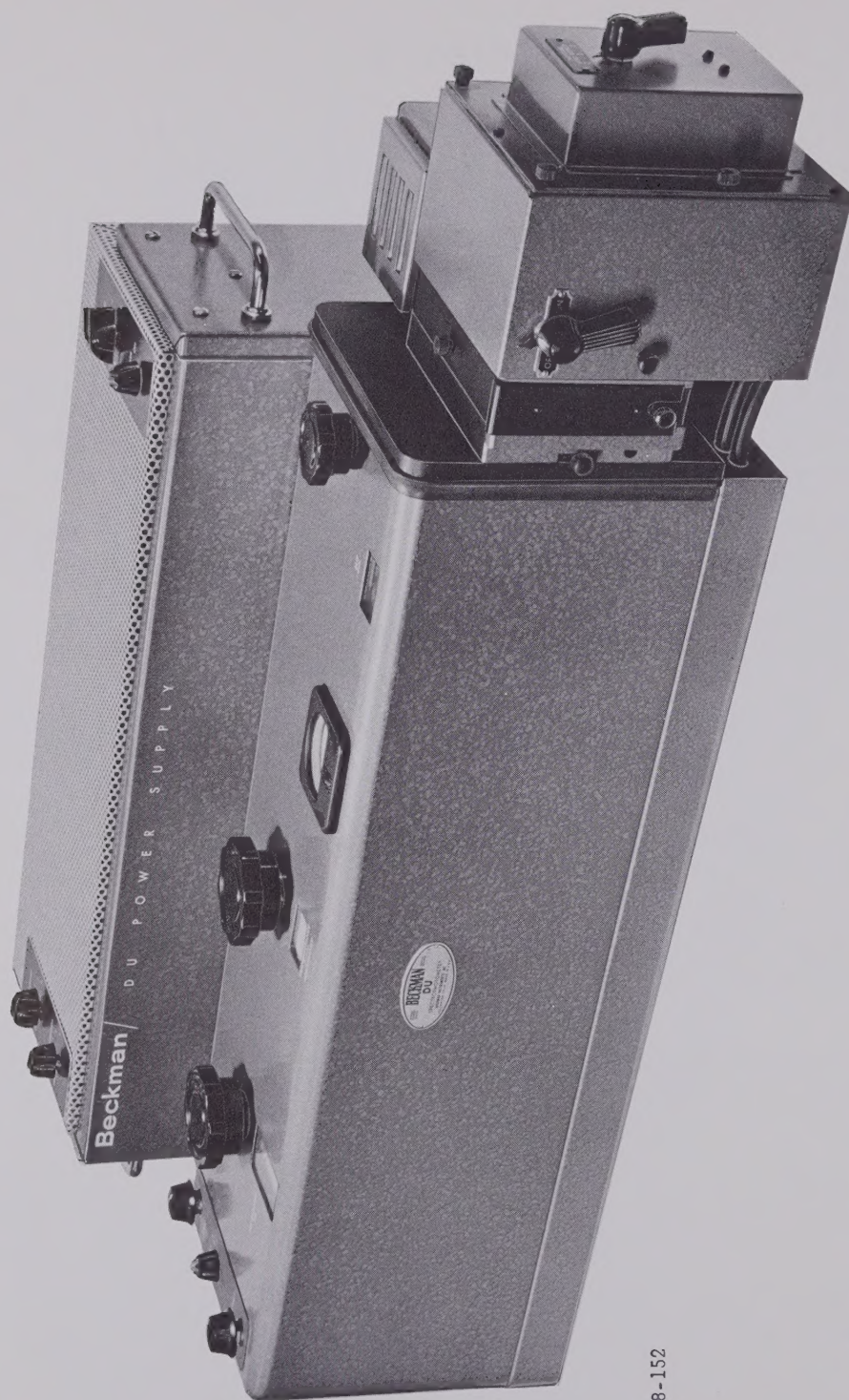
1. Introduction

1.1 General

The A.C. Power Supply for the BECKMAN DU Spectrophotometer is available in 115 and 230 volt models. Both models may be obtained separately for installation on existing instruments or as parts of group assemblies with either Phototube or Photomultiplier-equipped Spectrophotometers.

Installation procedures are detailed for all of these setups in the following text. For your convenience, BECKMAN part numbers of the units and combinations of units available are listed below:

<u>DESCRIPTION</u>	<u>BECKMAN NUMBER</u>
DU Power Supply purchased separately for installation on existing instrument, 115 v ac.	23700
DU Power Supply purchased separately for installation on existing instrument, 230 v ac.	23701
DU Power Supply and Spectrophotometer Group Assembly, 115 v ac with Photomultiplier	13400
DU Power Supply and Spectrophotometer Group Assembly, 230 v ac with Photomultiplier.	16100
DU Power Supply and Spectrophotometer Group Assembly, 230 v ac with phototube.	16200



58-152

FIGURE 2. POWER SUPPLY WITH DU

1.2 Description

The BECKMAN DU Power Supply (Figure 1) is an a-c operated unit designed for use with the BECKMAN DU Spectrophotometer. This single unit provides all the power required to operate a DU Spectrophotometer, or any DU-accessory combination. The DU Power Supply improves over-all operating stability of the DU, and reduces servicing and maintenance.

Operating from a 115- or 230-volt a-c power line, the Power Supply provides regulated voltages required for operation of the DU, the Tungsten Lamp, and the Hydrogen Lamp. When the instrument is operated with the Photomultiplier Attachment, the Power Supply powers the Photomultiplier as well, eliminating the need for the Battery Box and the dry cells.

The unit will also operate the BECKMAN 2260 Mercury Lamp, which is convenient for transmittance measurements and for calibrating the Wavelength Scale of the instrument. Providing necessary power for either the Hydrogen Lamp or the Mercury Lamp, the unit replaces the Hydrogen Lamp Power Supply of the Ultraviolet Accessory set.

All cables necessary for the installation and operation of the DU Power Supply with the DU Spectrophotometer and accessories are provided. Certain of the jumper wires and electronic components will not be required in some cases, depending upon the extent to which the DU has been modified previously.

A compact Filter Assembly is supplied with the Power Supply; this unit is designed for easy installation in the Battery Compartment of instruments which have not been equipped with the Photomultiplier Attachment. This Filter Assembly cannot be used on instruments which have been modified to accommodate the Photomultiplier Attachment. In this case it is necessary to install special filter components, supplied with the Power Supply, within the Photomultiplier Receiver Compartment. On Power Supply units purchased as part of a Group Assembly, all of the preceeding installation will have been done.

1.3 Specifications:

(a) Dimensions

Length:	22	inches
Width:	7 1/2	inches
Height:	11	inches

(b) Weight

Instrument Weight:	35	pounds
Shipping Weight:	50	pounds

(c) Requirements

Input Power:	100-130 volts
	or
	200-260 volts
	50/60 cycles
	500 watts

(d) Output

Required voltages for operation of:

DU Spectrophotometer
Photomultiplier Attachment
Hydrogen Lamp
Mercury Lamp
Tungsten Lamp

Operational Notes

Before installing the BECKMAN Power Supply on the DU Spectrophotometer, confirm the satisfactory operation of the DU. Remember that the Power Supply will in no way alleviate performance difficulties which exist in the spectrophotometer. Refer to BECKMAN Instruction Manual 305, Section II, and adjust the DU for peak performance, giving special emphasis to the following items prior to Power Supply installation:

1. Performance of 2531 and 2532 amplifier tubes.
2. Correct Tungsten Lamp focus.
3. Hydrogen Lamp voltage. (A Hydrogen lamp firing at over 120V - cathode to anode - should be replaced.)
4. Determine that all terminal and ground connections are clean and tight.
5. Make sure that power line in which the Power Supply will be operated will supply a minimum of 100V when the 5 amp load of the Power Supply is added.

POWER SUPPLY MUST BE OPERATED IN UPRIGHT POSITION. DO NOT PLACE UNIT ON SIDE UNDER ANY CONDITIONS. DO NOT OPERATE WITH ANYTHING ON OR NEAR UNIT WHICH WILL INTERFERE WITH FREE CIRCULATION OF AIR.

1.4 Operation

1.5 General

Operating procedures for a DU equipped with the BECKMAN DU Power Supply are essentially the same as those described in Instruction Manual 305, MODEL DU SPECTROPHOTOMETER. Slight variations in procedures are noted in the following paragraphs of this Section, in which the different modes of operation are discussed.

When the DU is operated with the Power Supply, a slight interaction may be noted between the Dark Current Control and the Sensitivity Control. This interaction between controls is normal, and should cause no confusion or difficulty in operating the instrument.

When the DU is turned on after the Power Supply is connected, if the Null Meter needle cannot be kept on scale by adjusting the Dark Current Control (needle flips from one end of scale to the other) connect the 22 meg resistor (supplied) between terminals 2 and 3 of the Power Supply terminal strip. (This resistor, BECKMAN PART No. 8852, is color-coded Red-Red-Blue.)

1.6 Operating Controls

The DU Power Supply is controlled by four switches on the top panel of the unit and one switch on the left end of the case. (See Figure 2A) Functions and uses of these controls are outlined below:

(a) Power Switch

The Power Switch controls the operation of the Power Supply Unit as well as the power to the Tungsten Lamp and to the electronic circuits of the DU Spectrophotometer. It is unnecessary to use the "OFF" position of the Selector Switch on the DU, and in some installations this switch position does not function.

(b) Hydrogen Lamp Switch

The eight-position Hydrogen Lamp Switch controls operation of the Hydrogen Lamp or the Mercury Lamp. This switch controls Filament and Anode voltages supplied to the Hydrogen or Mercury Lamps.

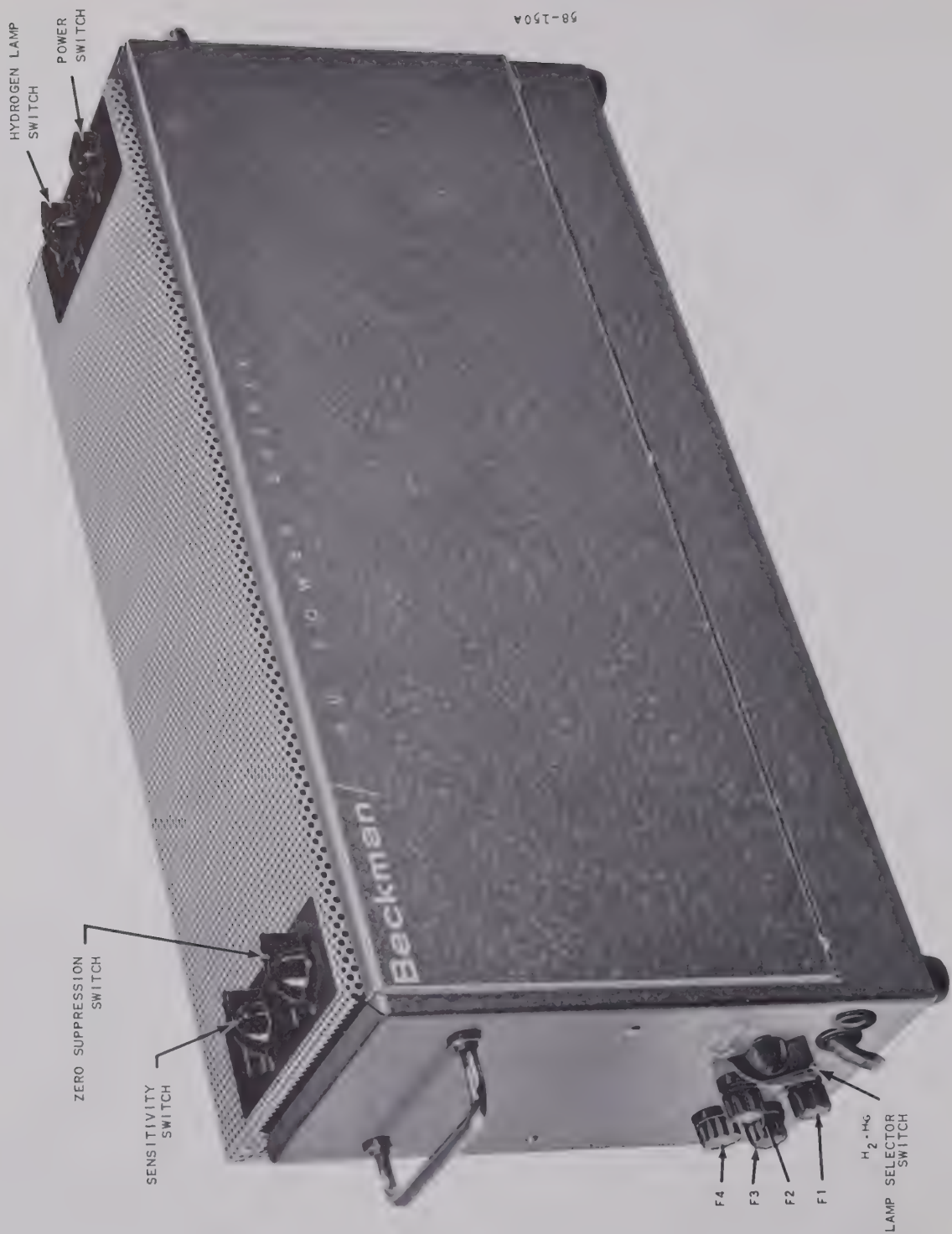


FIGURE 2A. OPERATING CONTROLS

The OFF position provides for operation of the Spectrophotometer when neither the Hydrogen Lamp nor the Mercury Lamp is used. The WARM-UP position provides a suitable warm-up voltage for the lamp Filament, and the 1 - 6 positions provide various operating voltages, decreasing from the 1 position to the 6 position. For selection of correct operating position, see Paragraphs 1.7 or 1.8. Each time the Power Supply is turned off, the Hydrogen Lamp Switch must first be turned to OFF before the Power Supply is again turned ON, and must remain in the OFF position during the first minute following turning on the Power Supply

(c) Hydrogen Lamp - Mercury Lamp Selector Switch

This two-position switch adjusts the output of the Hydrogen Lamp circuit of the Power Supply so that a Mercury Lamp may be used instead of the Hydrogen Lamp. When the switch is in the Hg position, a dummy-load resistor is placed in the circuit, providing suitable voltage for operation of the Mercury Lamp.

(d) Sensitivity Switch

The Sensitivity Switch, which is functional only when the Spectrophotometer is operated with the Photomultiplier Attachment, is designed to reduce the sensitivity of the Multiplier Phototube when high sensitivity is not required. This switch permits variation in sensitivity from maximum (FULL) through nine steps to minimum sensitivity (Position 1).

(e) Zero Suppression Switch

The Zero Suppression Switch is functional only when the Spectrophotometer is operated with the Photomultiplier Attachment. This Switch may be used to suppress background radiation for flame, fluorescence, and reflectance measurements.

In flame photometry, for example, the switch is adjusted until a solution containing 0 ppm of the element being determined reads 0 on the scale. In other words, the scale is expanded several fold. This adjustment is particularly important when working with a wide range of concentrations.

Should the Tungsten Lamp switch be turned on or off, there will be a variation in Zero Suppression voltage. In this case, it may be necessary to reset the dark-current control.

(f) Screen Bias Switch

The Screen Bias Switch, a screw-driver adjustment located at the lower-rear of the Power Supply Unit, controls the screen biasing voltage of the 2532 tube in the DU Spectrophotometer amplifier. It functions as a coarse adjustment in conjunction with the Dark Current Control.

1.7 Operation with Tungsten Lamp

To place the DU Spectrophotometer in operation when using the Power Supply and the Tungsten Lamp, proceed as follows:

- (1) Connect Power Supply to appropriate 50/60 cycle electrical source.
- (2) Turn Shutter Switch OFF.
- (3) Turn Tungsten Lamp Switch ON. (Refer to Para. 3.4 for procedure on establishing tungsten lamp intensity level.)
- (4) Set Selector Switch to CHECK.
- (5) Turn Power Switch ON.
- (6) Allow instrument to warm up for one hour to insure operation of the DU to within its rated specifications. A warm-up time of a half hour will suffice if an accuracy of 0.5%T (under standard operating procedures) can be tolerated. Improvement in component life may be expected if the Power Supply is turned off whenever the DU will be inoperative for periods of eight hours or more.
- (7) Proceed as for normal operation of instrument as described in Instruction Manual 305, MODEL DU SPECTROPHOTOMETER, using the Screen Bias Switch in place of the roving battery-tap lead.

NOTE

To extend life of the Tungsten Lamp, turn Lamp off when not in use. A slight drift in light intensity will occur for about 15 minutes when the Lamp is turned on again; this drift is due to change of temperature of the Lamp compartment. When slit widths are changed radically, excessive noise or a drift in Tungsten light intensity may develop. To insure minimum noise level and drift, first select the required slit width, and then adjust the Tungsten Lamp for optimum focus.

1.8 Operation with Hydrogen Lamp

To place the DU Spectrophotometer in operation when using the Power Supply and the Hydrogen Lamp, proceed as follows:

- (1) Connect the Power Supply to appropriate 50/60 cycle electrical source.
- (2) Turn Shutter Switch OFF.
- (3) Turn Selector Switch to CHECK.
- (4) Turn Power Switch ON.
- (5) Proceed as for normal operation of instrument as described in Instruction Manual 305, MODEL DU SPECTROPHOTOMETER, using Screen Bias Switch in place of roving battery-tap lead.
- (6) Allow instrument to warm up for one hour to insure operation of the DU to within its rated specifications. A warm-up time of a half hour will suffice if an accuracy of 0.5%T (under standard operating procedures) can be tolerated. Improvement in component life may be expected if the Power Supply is turned off whenever the DU will be inoperative for periods of eight hours or more.
- (7) Turn Lamp Selector Switch to H₂.
- (8) Turn Hydrogen Lamp Switch to WARM-UP position.
- (9) ALLOW FILAMENT TO WARM UP WITH SWITCH IN WARM-UP POSITION FOR 30 SECONDS.
- (10) TURN HYDROGEN LAMP SWITCH THROUGH THE 1 POSITION TO THE 2 POSITION. LAMP SHOULD FIRE. IF LAMP FAILS TO FIRE WITHIN 3 OR 4 MINUTES, REPLACE LAMP.
- (11) When Hydrogen Lamp fires, rotate switch to position which yields maximum energy. To ascertain correct operational setting of this switch, proceed as follows:
 - (a) Rotate Slit Adjustment Control until slit width is 2 mm.

- (b) Rotate Sensitivity Control on DU to full counterclockwise position.
 - (c) Rotate Wavelength Selector to null balance condition as indicated on Null Meter. (Null balance should be obtained with wavelength setting of near $210\text{ m}\mu$.)
 - (d) Rotate Hydrogen Lamp Switch, balancing Null Meter at each switch position by changing wavelength setting as necessary to balance. Note switch position giving null balance at lowest wavelength. This is correct operational setting of the Hydrogen Lamp Switch.
- (12) It is possible that fluctuations of the null meter (dark-current noise) may be observed when the Hydrogen Lamp is turned on. If this happens, the difficulty may be remedied by moving the green lead from terminal No. 20 of the DU POWER SUPPLY terminal strip to the adjacent terminal - No. 19. Should this fail to reduce the noise level, measure Hydrogen Lamp voltage from cathode to anode. A Hydrogen Lamp measuring over 120 volts should be replaced.

1.9 Operation with Mercury Lamp

To place the DU Spectrophotometer in operation when using the Power Supply and the Mercury Lamp, proceed as follows:

- (1) Connect Power Supply to appropriate 50/60 cycle electrical source.
- (2) Turn Shutter Switch OFF.
- (3) Turn Selector Switch to CHECK.
- (4) Turn Power Switch ON.
- (5) Proceed as for normal operation of instrument as described in Instruction Manual 305, MODEL DU SPECTROPHOTOMETER, using the Screen Bias Switch in place of roving battery-tap lead.

- (6) Allow instrument to warm up for one hour to insure operation of the DU to within its rated specifications. A warm-up time of a half hour will suffice if an accuracy of 0.5%T (under standard operating procedures) can be tolerated. Improvement in component life may be expected if the Power Supply is turned off whenever the DU will be inoperative for periods of eight hours or more.
- (7) Turn Lamp Selector Switch to Hg position.
- (8) Turn Hydrogen Lamp Switch to WARM-UP position.
- (9) Allow Mercury Lamp Filament to warm up with switch in this position for one minute.
- (9A) Then turn Hydrogen Lamp Switch to position 1.
- (10) When Mercury Lamp fires, rotate switch to position which yields maximum energy. To ascertain correct operational setting of this switch, proceed as follows:
 - (a) Rotate Slit Adjustment Control until slit width is 2 mm.
 - (b) Rotate Sensitivity Control on DU to full counterclockwise position.
 - (c) Rotate Wavelength Selector to null balance condition as indicated on Null Meter. (Null balance should be obtained with wavelength setting of near 210 mμ.)
 - (d) Rotate Hydrogen Lamp Switch, balancing Null Meter at each switch position by changing wavelength setting as necessary to balance. Note switch position giving null balance at lowest wavelength. This is correct operational setting of the switch for Mercury Lamp.

NOTE

If Mercury Lamp is to be used only for wavelength calibration purposes, it is not necessary to operate at maximum energy. In this case, after lamp fires, turn switch to position 3 or 4 and proceed with calibration.

1.10 Operation with Photomultiplier Attachment

Operation of the DU with Photomultiplier Attachment is essentially the same as the procedure outlined in Instruction Manual 305. The Sensitivity Switch and Zero Suppression Switch are incorporated into the Power Supply unit and are used in the same manner as the controls formerly on the Photomultiplier Attachment battery box.

To operate the Photomultiplier Attachment when using the Power Supply, follow the procedure outlined below.

- (1) Place Tungsten Lamp in operation as outlined in Par. 1.7, or Hydrogen Lamp as outlined in Par. 1.8.
- (2) Rotate Wavelength Selector to desired wavelength.
- (3) Pull Phototube Positioning Knob out to position Multiplier Phototube.
- (4) Turn Sensitivity Switch on Power Supply to FULL.

NOTE

The Sensitivity Switch is located on the top of the Power Supply Unit; do not confuse with the Sensitivity Control on the DU.

- (5) Zero the meter needle using Zero Suppression Switch to make a coarse adjustment, and Dark Current Control to make a fine adjustment.
- (6) Operate other DU controls in the usual manner for Transmittance measurements.

NOTE

For flame photometry, light burner and follow other operating procedures described in Instruction Manual 334.

1.11 CIRCUIT OPERATION

1.12 General

The purpose of the DU Power Supply is to provide all required d-c voltages for the operation of a DU Spectrophotometer, as well as the necessary voltages for the Hydrogen Lamp or the Mercury Lamp, the Tungsten Lamp, and the Photomultiplier Attachment.

The DU Power Supply replaces all batteries normally used with the DU, eliminates the need for the Battery Power Regulator, and supplants the Hydrogen Lamp Power Supply. Operating stability of the instrument is increased, maintenance is reduced, and the replacement of batteries is eliminated when the Power Supply is used.

1.13 Input Circuits

The 115 volt DU Power Supply operates on an input voltage of 100 to 130 volts and the 230 volt Power Supply operates within the 200 to 260 volt range. Both units are designed for 50 to 60 cycles a-c. The Input Circuit is protected by fuses F1 and F2 (5 amp for 115 volt and 3 amp for 230 volt) and is controlled by the Power Switch SW1, connected in series with the primary of the Power Transformer T1. The a-c power cable is a three-conductor type and is provided with a three-pronged plug permitting suitable grounding of the Power Supply Unit.

1.14 Output Circuits

Two Output Transformers are utilized in the Power Supply, providing well filtered and closely regulated voltages for the various circuits of the DU and accessories. Transformer T3 provides a-c voltages which are rectified and filtered to yield stable d-c supplies which replace the batteries originally used to power the instrument.

Transformer T2 provides 6 volts a-c to power the Tungsten Lamp; this 6-volt supply is not rectified. Regulation in the intermediate stage of the Power Supply is sufficient to produce satisfactory stability for the Tungsten Lamp.

T2 also supplies 2.8 volts a-c for operating the heater of the Hydrogen Lamp. Output at the Hydrogen Lamp terminal is a maximum of 2.2 volts.

Transformer T3 is driven alternately by the separate sections of V7, functioning as switching tubes; T2 is driven alternately by V5 and V6, also functioning as switching tubes. Tubes V5, V6, and V7 are driven by a multivibrator circuit containing V4.

The Photomultiplier Output includes a high-voltage supply and a low-voltage d-c supply for the zero suppression circuit. The high-voltage supply is derived from the high-voltage winding on T2, rectified by V9. An a-c voltage of approximately 600 volts relative to ground is applied to V9; the d-c output from V9 is filtered by C8, and is delivered through the Sensitivity Switch to the Photomultiplier Tube.

The Sensitivity Switch places the required resistance in series with the Dynode divider of the Photomultiplier Tube, to give the desired instrument sensitivity when operated with the Photomultiplier Attachment.

The zero suppression circuit derives a d-c voltage from the 6-volt winding of T2 (Tungsten Lamp output); the a-c voltage is rectified by CR16 and filtered by C15. The Zero Suppression Switch selects a portion of the d-c voltage to attain the desired suppression effect.

1.15 Regulated B+ Supply Circuit

The constancy of the output voltages of T2 and T3 is dependent upon the stability of the voltage placed across the primaries of these transformers. The input voltage, which is nearly double the B+ voltage, would vary with variations in the B+ supply. The B+ supply is well-regulated, to insure stability of the output voltages of T2 and T3.

Output from the Power Transformer T1 is rectified and filtered, giving an unregulated B+ supply of approximately 485 volts (with line voltage of approximately 115 or 230 volts). A series-type regulator circuit is employed, the series-parallel combination of V3, V10, R5, and R28 constituting the variable series impedance.

Tube V8 acts as a voltage reference tube, providing a reference voltage of 85 volts. The difference between this reference 85 volts and a B- 85 volts, derived from the output of V3 and V10 through a voltage divider, produces an unbalance in plate voltages in V2, which acts as a differential amplifier.

The changes in plate voltages on V2 are in opposite directions; both voltages act to define a new grid-to-cathode potential for the left section (as indicated on the Schematic Circuit Diagram) of V1. The output from V1 is applied to the grids of V3 and V10, correcting the output from these tubes to produce a stable, well-regulated B+ output, which is further filtered by C22.

SECTION 2

2. Installation

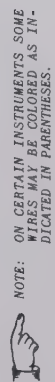
2.1 General

The DU Power Supply may be positioned conveniently behind the DU Spectrophotometer, as indicated in Figure 2. This location allows easy access to the Power Supply controls. As considerable heat is generated by the Power Supply, place the unit in such a position that the flow of air is not restricted.

The power cord is a three-conductor cable, provided with a three-pronged plug. A special adaptor is provided for use when the electrical outlet is not provided with a third (ground) contact. When using the adaptor, connect the pigtail lead to a good earth ground to insure non-hazardous operation of the Power Supply.

Installation procedures for the DU Power Supply vary slightly, depending upon the extent to which wiring of the DU has been modified previously to accommodate accessories. When connecting the DU Power Supply, do not alter any wiring except as instructed in the procedure applicable to your instrument.

To install the DU Power Supply for use with a DU Spectrophotometer, examine the instrument to determine which accessory or combination of accessories, if any, has been attached to the instrument previously. Then select the proper installation procedure for your instrument from the list on the following page:

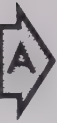


2-2

TO INSTALL DU POWER SUPPLY ON . . .

- DU SPECTROPHOTOMETER NOT MODIFIED FOR ACCESSORIES OR MODIFIED FOR SERA OR ERA ONLY (115 or 230 VOLT)

TURN TO



- DU SPECTROPHOTOMETER EQUIPPED WITH BATTERY POWER REGULATOR ONLY OR WITH BATTERY POWER REGULATOR AND SERA OR ERA (115 or 230 VOLT)

TURN TO



- DU SPECTROPHOTOMETER EQUIPPED WITH PHOTOMULTIPLIER ATTACHMENT (115 or 230 VOLT)

TURN TO



- DU SPECTROPHOTOMETER EQUIPPED WITH PHOTOMULTIPLIER ATTACHMENT AND SERA OR ERA (115 or 230 VOLT)

TURN TO



- DU SPECTROPHOTOMETER EQUIPPED WITH PHOTOMULTIPLIER ATTACHMENT AND BATTERY POWER REGULATOR (115 or 230 VOLT)

TURN TO



- DU SPECTROPHOTOMETER EQUIPPED WITH PHOTOMULTIPLIER ATTACHMENT, BATTERY POWER REGULATOR AND SERA OR ERA (115 or 230 VOLT)

TURN TO



TO INSTALL GROUP ASSEMBLY (SPECTROPHOTOMETER FACTORY-EQUIPPED WITH POWER SUPPLY). . . .

- 115 or 230 VOLT WITH PHOTOMULTIPLIER ATTACHMENT

TURN TO



- 230 VOLT (ONLY) WITH PHOTOTUBE

TURN TO



SECTION 2A

2A. INSTALLATION WITH UNMODIFIED DU OR DU WITH SERA OR ERA

Installation procedures are identical for installing the DU Power Supply for use with a DU unmodified for any accessories or attachments, or for an instrument modified only for use with the SERA or the ERA.

Figure 3 illustrates the terminal strip connections of a standard DU Spectrophotometer which has not been modified previously. Terminal strip connections of the standard DU with the Power Supply added are indicated in Figure 4. Terminal strip connections of a DU modified for use with the SERA or the ERA are shown in Figure 5.

To install the Power Supply in either of these cases, follow the detailed procedure outlined below:

- (1) Disconnect the three leads from the 6-volt storage battery terminals
- (2) Remove Cell Compartment Cover, Cell Holder, and Lamp House Cover from instrument.
- (3) Invert instrument on two padded blocks spaced between Wavelength Selector and Slit Adjustment Control.
- (4) Remove Bottom Cover Plate from Battery Compartment.
- (5) Disconnect and remove six "C" batteries from Battery Compartment.
- (6) Disconnect 6-volt storage battery leads from terminals on DU terminal strip. (See Figure 3.)
- (7) Remove storage battery cable from Battery Compartment by pulling through grommet at left end of Monochromator.

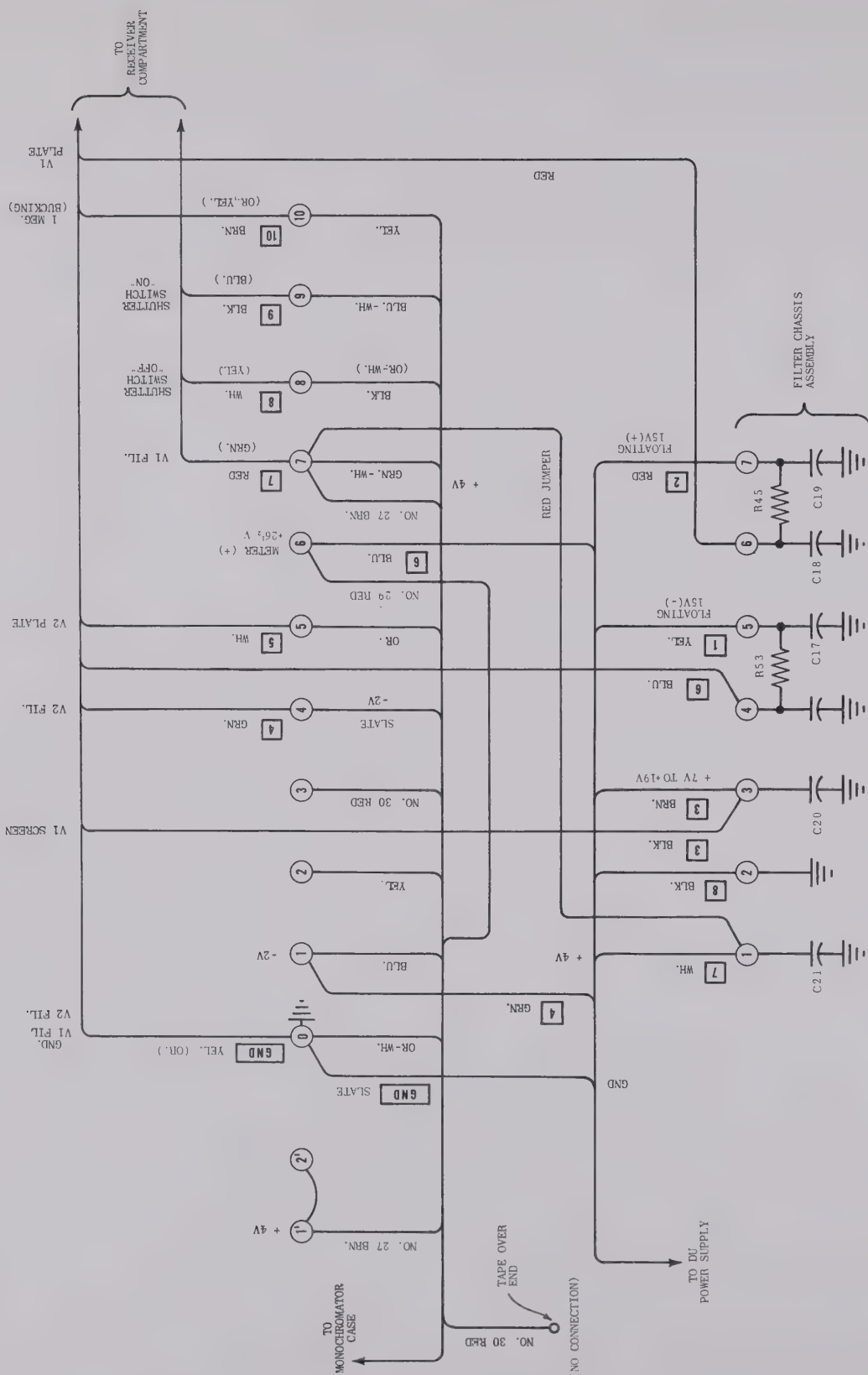


FIGURE 4. DU TERMINAL STRIP WITH POWER SUPPLY CONNECTED

NOTE

Instruments provided with a 2330 Lamp House (not equipped with liquid-cooling coils) also have a cable connecting the Tungsten Lamp to terminals 1 and 2 on the terminal strip. Disconnect these Tungsten Lamp leads from the terminal strip and pull cable from Battery Compartment.

- (8) Remove nut attaching right end of terminal strip to instrument.
- (9) Place Filter Chassis Assembly (provided with Power Supply Unit) in space originally occupied by Battery No. 5. (See Figure 7A). Mounting bracket hole will align with screw hole in terminal strip.

NOTE

When installing Filter Chassis Assembly, in order to insure adequate thread grip on attaching screw, replace existing terminal strip spacer with shorter 8538 spacer supplied with unit.

- (10) Replace nut removed in (8) attaching Filter Chassis Assembly and terminal strip to instrument. Tighten nut securely.
- (11) Connect Red jumper from Filter Chassis terminal 1 to terminal 7 on DU terminal strip.
- (12) Remove Black lead from terminal 3 on DU terminal strip and connect this lead to Filter Chassis terminal 3.
- (13) Remove Blue lead from terminal 6 on DU terminal strip and connect this lead to Filter Chassis terminal 4.
- (14) Connect Red lead formerly on Battery 6 (+) to Filter Chassis terminal 6.
- (15) Connect Red lead formerly on Battery 4 (+) to terminal 6 on DU terminal strip.
- (16) Tape end of Red lead formerly connected to Battery 1 (+). (No connection.)



- (17) Feed cable from Power Supply Unit into Battery Compartment through hole in left end formerly occupied by Battery Cable.
- (18) Connect Power Supply cable leads as indicated below: (Refer to Figure 4.)

Slate—to DU terminal strip ground terminal
Green—to terminal 1 on DU terminal strip
White—to Filter Chassis terminal 1
Black—to Filter Chassis terminal 2
Brown—to Filter Chassis terminal 3
Yellow—to Filter Chassis terminal 5
Blue—to terminal 6 on DU terminal strip
Red—to Filter Chassis terminal 7

- (19) Replace Bottom Cover Plate on Battery Compartment.
- (20) Turn instrument right side up, replace Lamp House Cover, Cell Holder, and Cell Compartment Cover.
- (21) Connect leads from Tungsten Lamp to terminals on right end of Power Supply Unit.
- (22) If Hydrogen Lamp or Mercury Lamp is used, plug connector from Lamp into socket on right end of Power Supply Unit.
- (23) Connect the DU case to a good earth ground. Make this ground connection to one of the screws attaching the Photomultiplier Receiver Compartment cover.
- (24) Connect the Recorder ground terminal (on terminal strip at lower right corner inside Recorder) to good earth ground.

SECTION 2B

2B. INSTALLATION WITH DU MODIFIED FOR USE WITH BATTERY POWER REGULATOR OR BATTERY POWER REGULATOR AND SERA OR ERA

Installation procedures for connecting the Power Supply with a DU which has been in use with the 1900 Battery Power Regulator are identical whether or not the instrument has been modified for use with the SERA or the ERA.

Terminal strip connections of the DU to which a Battery Power Regulator has been attached are indicated in Figure 6. Terminal strip connections of a DU provided with the Battery Power Regulator and the SERA or the ERA are shown in Figure 7.

To install the Power Supply with a DU modified in either of these ways, follow the procedure outlined below:

- (1) Disconnect Battery Power Regulator from a-c electrical source.
- (2) Remove cover from Battery Power Regulator, and remove all cable leads from terminal strip.
- (3) Remove DU Cell Compartment Cover, Cell Holder, and Lamp House Cover.
- (4) Invert instrument on two padded blocks spaced between Wavelength Selector and Slit Adjustment Control.
- (5) Remove Bottom Cover Plate from Battery Compartment.
- (6) Remove nut attaching right end of DU terminal strip.
- (7) Place Filter Chassis Assembly provided with Power Supply in space originally occupied by Battery No. 5. (See Figure 7A) Mounting bracket hole will align with screw hole in terminal strip.

NOTE

When installing Filter Chassis Assembly, in order to insure adequate thread grip on attaching screw, replace existing terminal strip spacer with shorter 8538 spacer supplied with unit.



TO BATTERY POWER REGULATOR
(MODEL 1900 OR MODEL 14500)

- (8) Replace nut removed in (6), attaching Filter Chassis assembly and terminal strip to instrument. Tighten nut securely.
- (9) Separate Red lead of Battery Power Regulator cable from Red instrument lead at taped connection. (See Figure 6 or Figure 7.)
- (10) Connect Red instrument lead (step 9 above) to Filter Chassis terminal 6.
- (11) Separate Yellow lead of Battery Power Regulator cable from Red instrument lead at taped connection.
- (12) Connect Red instrument lead (step 11 above) to terminal 6 of DU terminal strip.
- (13) Disconnect remaining Battery Power Regulator cable leads from the DU terminal strip. Remove this cable from Battery Compartment by pulling through grommet at left end of Monochromator.
- (14) Remove Blue lead from terminal 6 of DU terminal strip and connect this lead to Filter Chassis terminal 4.
- (15) Connect Red jumper from Filter Chassis terminal 1 to terminal 7 on DU terminal strip.
- (16) Remove Black lead from terminal 3 on DU terminal strip and connect this lead to Filter Chassis terminal 3.
- (17) Feed cable from Power Supply unit into Battery Compartment through hole in left end formerly occupied by Battery Power Regulator cable.
- (18) Connect Power Supply cable leads as indicated below: (Refer to Figure 6 or Figure 7.)

Slate	to DU terminal strip ground terminal
Green	to terminal 1 on DU terminal strip
White	to Filter Chassis terminal 1
Black	to Filter Chassis terminal 2
Brown	to Filter Chassis terminal 3
Yellow	to Filter Chassis terminal 5
Blue	to terminal 6 on DU terminal strip
Red	to Filter Chassis terminal 7

- (19) Replace Bottom Cover Plate on Battery Compartment.
- (20) Turn Instrument right side up, replace Lamp House Cover, Cell Holder, and Cell Compartment Cover.
- (21) Connect leads from Tungsten Lamp to terminals on right end of Power Supply Unit.

- (22) If Hydrogen Lamp or Mercury Lamp is used, plug connector from Lamp into socket on right end of Power Supply Unit.
- (23) Connect the DU case to a good earth ground. Make this ground connection to one of the screws attaching the Photomultiplier Receiver Compartment cover.
- (24) Connect the Recorder ground terminal (on terminal strip at lower right corner inside Recorder) to good earth ground.

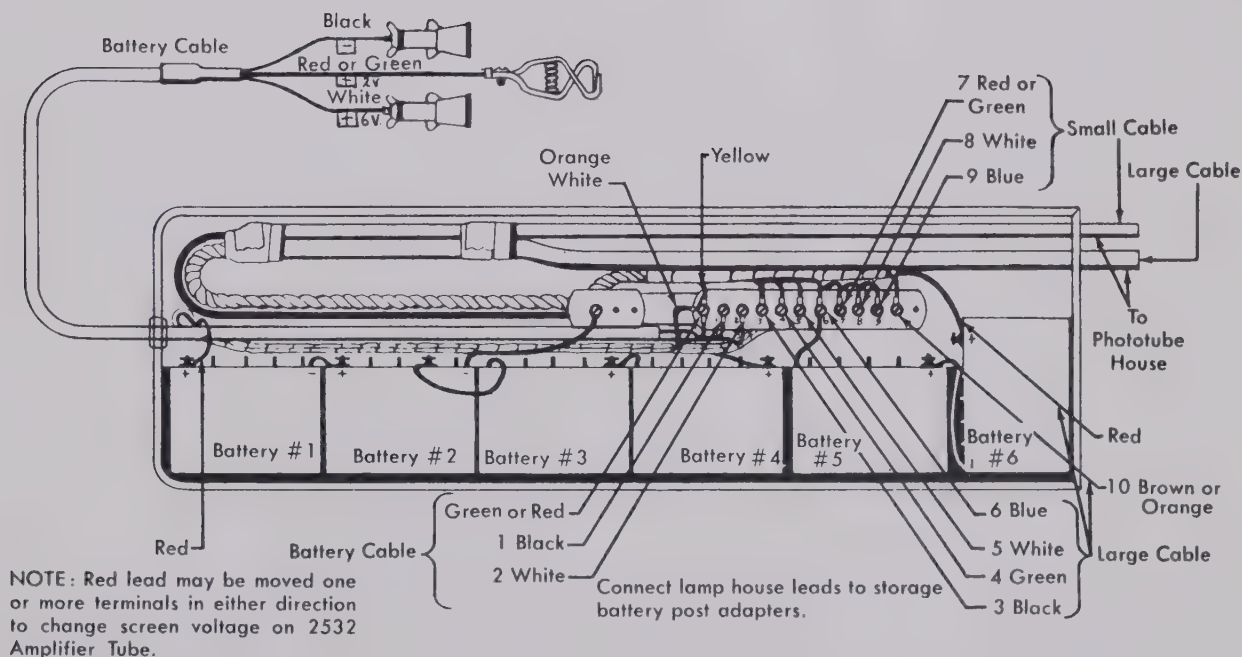


FIGURE 7A. DIAGRAM OF DU BATTERY COMPARTMENT

SECTION 2C

2C. INSTALLATION WITH DU MODIFIED FOR USE WITH PHOTOMULTIPLIER ATTACHMENT

Terminal strip connections of a DU to which a Photomultiplier Attachment has been added are indicated in Figure 8. This diagram is given for reference purposes only. Terminal strip connections after installation of the Power Supply unit are shown in Figure 8A.

To install the Power Supply with a DU modified for use with Photomultiplier Attachment, follow the procedure outlined below:

- (1) Disconnect the three leads from the 6-volt storage battery terminals.
- (2) Remove Cell Compartment Cover, Cell Holder, and Lamp House Cover from DU.
- (3) Invert instrument on two padded blocks spaced between Wavelength Selector and Slit Adjustment Control.
- (4) Remove Bottom Cover Plate from DU Battery Compartment.
- (5) Disconnect 6-volt storage battery cable leads from terminals on DU terminal strip.
- (6) Remove storage battery cable from Battery Compartment by pulling through grommet at left end of Monochromator.
- (6a) Disconnect the green lead from terminal No. 4 on the terminal strip and connect it to terminal No. 1.

NOTE

Instruments provided with a 2330 Lamp House (not equipped with liquid-cooling coils) also have a cable connecting the Tungsten Lamp to terminals 1 and 2 on the terminal strip. Disconnect these Tungsten Lamp leads from the terminal strip and pull cable from Battery Compartment.

- (7) Remove cover from Photomultiplier Battery Box.
- (8) Disconnect the three cables from Battery Box terminal strip.



FIGURE 8. DU TERMINAL STRIP WITH PHOTOMULTIPLIER ATTACHMENT CONNECTED

NOTE

The Photomultiplier Battery Box is not required for operation of the instrument when the Power Supply is used.

- (9) Invert Power Supply unit on two padded blocks.
- (10) Remove Bottom Cover Plate from Power Supply.
- (11) Detach cable leads attached to Power Supply terminal strip.

NOTE

This cable is not required when the DU has been equipped formerly with the Photomultiplier Attachment.

- (12) Feed the three cables formerly attached to Battery Box through grommets in right end of Power Supply unit.
- (13) Remove the tape which protects the serving at the ends of the shields of the two cables from the Photomultiplier Receiver Compartment.
- (14) Solder one of the two black jumpers (provided with lugs on one end), supplied, to the serving of each of these cables.
- (15) Tape the serving and soldered connections with electrical tape.
- (16) Connect the lugs of the two black jumpers (15, above) to the "0" (ground) terminal of the Power Supply terminal strip.
- (17) Attach the leads of the three cables (12, above), to corresponding numbered terminals of Power Supply terminal strip.
- (18) Connect .002 capacitor (C28), supplied, between terminals 1 and 4 of Power Supply terminal strip.
- (19) Replace Bottom Cover Plate on DU, and turn instrument right side up.
- (20) Replace Bottom Cover Plate on Power Supply and turn right side up.
- (21) Connect Tungsten Lamp leads to terminals on right end of Power Supply.
- (22) If Hydrogen Lamp or Mercury Lamp is to be used, plug connector on Lamp cable into socket on right end of Power Supply unit.
- (23) Modify Photomultiplier Receiver Compartment wiring as directed in Section 2F, Paragraph 2F.1.



SECTION 2D

2D. INSTALLATION WITH DU MODIFIED FOR USE WITH PHOTOMULTIPLIER ATTACHMENT AND SERA OR ERA

Terminal strip connections of a DU to which a Photomultiplier Attachment and the SERA or the ERA have been added are indicated in Figure 9. This diagram is given for reference purposes only. Terminal strip connections after installation of Power Supply Unit are shown in Figure 10.

To install the Power Supply with a DU modified for use with Photomultiplier Attachment and SERA or ERA, follow the procedure outlined below:

- (1) Disconnect the three leads from the 6-volt storage battery terminals.
- (2) Remove Cell Compartment Cover, Cell Holder, and Lamp House Cover from DU.
- (3) Invert instrument on two padded blocks spaced between Wavelength Selector and Slit Adjustment Control.
- (4) Remove Bottom Cover Plate from DU Battery Compartment.
- (5) Disconnect 6-volt storage battery cable leads from terminals on DU terminal strip.
- (6) Remove storage battery cable from Battery Compartment by pulling through grommet at left end of Monochromator.
- (6a) Disconnect the No. 4 green lead from terminal 11-4 on the SERA terminal strip and connect it to terminal No. 1 on the DU terminal strip.

NOTE

Instruments provided with a 2330 Lamp House (not equipped with liquid-cooling coils) also have a cable connecting the Tungsten Lamp to terminals 1 and 2 on the terminal strip. Disconnect these Tungsten Lamp leads from the terminal strip and pull cable from Battery Compartment.

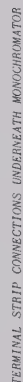
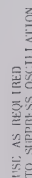
- (7) Remove cover from Photomultiplier Battery Box.
- (8) Disconnect the three cables from Battery Box terminal strip. (The Battery Box is not required for operation of the instrument when the Power Supply is used.)

- (9) Invert Power Supply unit on two padded blocks.
- (10) Remove Bottom Cover Plate from Power Supply.
- (11) Detach cable leads attached to Power Supply terminal strip. This cable will not be required when the DU has been equipped formerly with the Photomultiplier Attachment.
- (12) Feed the three cables formerly attached to Battery Box through grommets in right end of Power Supply unit.
- (13) Remove the tape which protects the serving at the ends of the shields of the two cables from the Photomultiplier Receiver Compartment.
- (14) Solder one of the two black jumpers (provided with lugs on one end), supplied, to the serving of each of these two cables.
- (15) Tape the serving and soldered connections with electrical tape.
- (16) Connect the lugs of the two black jumpers (14, above) to the "0" (ground) terminal of the Power Supply terminal strip.
- (17) Attach the leads of the three cables (12, above), except green No. 4 lead of Receiver Compartment cable, to corresponding numbered terminals of Power Supply terminal strip.

CAUTION

Do not confuse green No. 4 lead of Receiver Compartment cable with green No. 4 lead of Monochromator cable.

- (18) Clip off spade lug attached to green No. 4 lead of Receiver Compartment cable; strip insulation from end of lead, and tin exposed wire.
- (19) Connect and solder short green-white jumper wire, supplied, to green No. 4 wire (18, above).
- (20) Connect spade lug of short green-white jumper wire (19, above) to terminal 13 on Power Supply terminal strip.
- (21) Connect .002 capacitor (C28), supplied, between terminals 1 and 4 of Power Supply terminal strip.



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- (22) Connect one end of long green-white jumper wire, supplied, (provided with lugs on both ends), to terminal 13 on Power Supply terminal strip.
- (23) Pass long green-white jumper wire (22, above) through same grommet at end of Power Supply through which Monochromator cable passes.
- (24) Follow path of Monochromator cable with green-white jumper wire, and connect loose end of jumper to terminal 11-4 on auxiliary terminal strip on DU. Tape green-white wire to monochromator cable at convenient intervals.
- (25) Replace Bottom Cover Plate on DU, and turn instrument right side up.
- (26) Replace Bottom Cover Plate on Power Supply and turn right side up.
- (27) Connect Tungsten Lamp leads to terminals on right end of Power Supply.
- (28) If Hydrogen Lamp or Mercury Lamp is to be used, plug connector on Lamp cable into socket on right end of Power Supply unit.

NOTE

See Section 2F, Para. 2F.1 for instructions on installation of filter components for additional stability of operation.

- (29) Connect the DU case to a good earth ground. Make this ground connection to one of the screws attaching the Photomultiplier Receiver Compartment cover.
- (30) Connect the Recorder ground terminal (on terminal strip at lower right corner inside Recorder) to good earth ground.

SECTION 2E

2E. INSTALLATION WITH DU MODIFIED FOR USE WITH PHOTOMULTIPLIER ATTACHMENT AND BATTERY POWER REGULATOR

Terminal strip connections of a DU which has been prepared for use with the Battery Power Regulator and the Photomultiplier Attachment are indicated in Figure 11. This diagram is given for reference purposes only, indicating terminal strip connections of the modified instrument prior to attachment of the Power Supply unit.

To install the Power Supply with a DU modified for use with Photomultiplier Attachment and Battery Power Regulator, follow the procedure outlined below:

- (1) Disconnect Battery Power Regulator from a-c electrical source.
- (2) Remove cover from Battery Power Regulator, and remove all cable leads from terminal strip.
- (3) Remove DU Cell Compartment Cover, Cell Holder, and Lamp House Cover.
- (4) Invert DU on two padded blocks spaced between Wavelength Selector and Slit Adjustment Control.
- (5) Remove Bottom Cover Plate from Battery Compartment.
- (6) Disconnect Battery Power Regulator cable leads from DU terminal strip.
- (7) Remove Battery Power Regulator cable from Battery Compartment by pulling through grommet at left end of Monochromator.
- (7a) Disconnect the green lead from terminal No. 4 on the terminal strip and connect it to terminal No. 1.
- (8) Remove cover from Photomultiplier Battery Box.
- (9) Disconnect the three cables from the Battery Box terminal strip.

NOTE

The Photomultiplier Battery Box and the Battery Power Regulator are not required for operation of the instrument when the Power Supply is used.

- (10) Invert Power Supply unit on two padded blocks; remove Bottom Cover Plate.
- (11) Detach cable leads attached to Power Supply Terminal strip.

NOTE

This cable is not required when the DU has been equipped formerly with Photomultiplier Attachment.

- (12) Feed the three cables formerly attached to Battery Box through grommets in right end of Power Supply unit.
- (13) Remove the tape which protects the serving at the ends of the shields of the two cables from the Photomultiplier Receiver Compartment.
- (14) Solder one of the two black jumpers (provided with lugs at one end), supplied, to the serving of each of these two cables.
- (15) Tape the serving and soldered connections with electrical tape.
- (16) Connect the lugs of the two black jumpers (14, above) to the "0" (ground) terminal of the Power Supply terminal strip.
- (17) Attach the leads of the three cables (12, above) to corresponding numbered terminals of the Power Supply terminal strip. Then connect .002 capacitor (C28), supplied, between terminals 1 and 4 of Power Supply terminal strip. See Figure 8A for connections on Power Supply terminal strip.
- (18) Replace Bottom Cover Plate on DU, and turn instrument right side up.
- (19) Replace Bottom Cover Plate on Power Supply and turn right side up.
- (20) Connect Tungsten Lamp leads to terminals on right end of Power Supply.
- (21) If Hydrogen Lamp or Mercury Lamp is to be used, plug connector on Lamp cable into socket on right end of Power Supply unit.

NOTE

See Section 2F, Para. 2F.1 for instructions on installation of filter components for additional stability of operation.

SECTION 2F

2F. INSTALLATION WITH DU MODIFIED FOR USE WITH PHOTOMULTIPLIER ATTACHMENT, BATTERY POWER REGULATOR, AND SERA OR ERA

Terminal strip connections of a DU which has been prepared for use with Photomultiplier Attachment, Battery Power Regulator, and the SERA or the ERA are indicated in Figure 12. This diagram is given for reference purposes only, indicating terminal strip connections of the modified instrument prior to attachment of the Power Supply unit.

To install the Power Supply with a DU modified for use with Photomultiplier, Battery Power Regulator, and SERA or ERA, follow the procedure outlined below:

- (1) Disconnect Battery Power Regulator from a-c electrical source.
- (2) Remove cover from Battery Power Regulator, and remove all cable leads from terminal strip.
- (3) Remove DU Cell Compartment Cover, Cell Holder, and Lamp House Cover.
- (4) Invert DU on two padded blocks spaced between Wavelength Selector and Slit Adjustment Control.
- (5) Remove Bottom Cover Plate from Battery Compartment.
- (6) Disconnect Battery Power Regulator cable leads from DU terminal strip.
- (7) Remove Battery Power Regulator cable from Battery Compartment by pulling through grommet at left end of Monochromator.
- (7a) Disconnect the No. 4 green lead from terminal 11-4 on the SERA terminal strip and connect it to terminal No. 1 on the DU terminal strip.
- (8) Remove cover from Photomultiplier Battery Box.
- (9) Disconnect the three cables from the Battery Box Terminal strip.

NOTE

The Photomultiplier Battery Box and the Battery Power Regulator are not required for operation of the instrument when the Power Supply is used.

- (10) Invert Power Supply unit on two padded blocks; remove Bottom Cover Plate.



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- (11) Detach cable leads attached to Power Supply terminal strip.

NOTE

This cable is not required when the DU has been equipped previously with the Photomultiplier Attachment.

- (12) Feed the three cables formerly attached to Battery Box through grommets in right end of Power Supply unit.
- (13) Remove the tape which protects the serving at the ends of the shields of the two cables from the Photomultiplier Receiver Compartment.
- (14) Solder one of the two black jumpers (provided with lugs on one end), supplied, to the serving of each of these two cables.
- (15) Tape the serving and soldered connections with electrical tape.
- (16) Connect the lugs of the two black jumpers (14, above) to the "0" (ground) terminal of the Power Supply terminal strip.
- (17) Attach the leads of the three cables (12, above), except green No. 4 lead of Receiver Compartment cable, to corresponding numbered terminals of the Power Supply terminal strip. See Figure 10 for Power Supply terminal-strip connections.

CAUTION

Do not confuse green No. 4 lead of Receiver Compartment cable with green No. 4 lead of Monochromator cable.

- (18) Clip off spade lug attached to green No. 4 lead of Receiver Compartment cable; strip insulation from end of lead, and tin exposed wire.
- (19) Connect and solder short green-white jumper wire, supplied, to green No. 4 wire (18 above).
- (20) Connect spade lug of short green-white jumper wire (19, above) to terminal 13 on Power Supply terminal strip.
- (21) Connect .002 capacitor (C28), supplied, between terminals 1 and 4 of Power Supply terminal strip.
- (22) Connect one end of long green-white jumper, supplied, (provided with lugs on both ends), to terminal 13 on Power Supply terminal strip.

- (23) Pass long green-white jumper wire (22, above) through same grommet at end of Power Supply through which Monochromator cable passes.
- (24) Follow path of Monochromator cable with green-white jumper wire, and connect loose end of jumper to terminal 11-4 on auxiliary terminal strip on DU. Tape green-white wire to Monochromator cable at convenient intervals.
- (25) Replace Bottom Cover Plate on DU, and turn instrument right side up.
- (26) Replace Bottom Cover Plate on Power Supply and turn right side up
- (27) Connect Tungsten Lamp leads to terminals on right end of Power Supply.
- (28) If Hydrogen Lamp or Mercury Lamp is to be used, plug connector on Lamp cable into socket on right end of Power Supply Unit.

NOTE

See Section 2F, Para. 2F.1 for instructions on installation of filter components for additional stability of operation.

- (29) Connect the DU case to a good earth ground. Make this ground connection to one of the screws attaching the Photomultiplier Receiver Compartment cover.
- (30) Connect the Recorder ground terminal (on terminal strip at lower right corner inside Recorder) to good earth ground.

2F.1 MODIFICATION OF PHOTOMULTIPLIER RECEIVER COMPARTMENT WIRING

In order to attain additional stability of operation of a DU equipped with Photomultiplier Attachment, the wiring of the Photomultiplier Receiver Compartment may require modifications as outlined below. This will result in improved filtering, greatly reducing effect of line transients on operation of the instrument. Late model Photomultiplier Attachments already incorporate this modification, so compare the wiring in your Photomultiplier compartment with that shown in Figures 13 and 14 before proceeding.

- (1) Disconnect instrument from power source.
- (2) Remove Photomultiplier Receiver Compartment and Cell Compartment from DU.
- (3) Remove end cover plate from Photomultiplier Receiver Compartment.

NOTE

If instrument is equipped with a Resistor Box, place this box to one side without disconnecting leads to Photomultiplier Receiver Compartment.

- (4) Remove knurled nut and disconnect guard-ring leads (D, E, Figure 15) from binding post (A, Figure 13) at left of two Amplifier Tubes.

CAUTION

Do not touch Aquadag-coated glass envelope of the Amplifier Tubes. This coating acts as a conductor, and, if the Aquadag is transferred to other components by the fingers, current leakage will result. Handle tubes by grid caps or bases only.

- (5) Remove grid cap leads (F, G, Figure 15) from 2532 Amplifier Tube (left tube), and from 2531 Amplifier Tube (right tube).

NOTE

Instruments with serial numbers below 555 have a 2530 Amplifier Tube instead of a 2531 tube, unless these instruments have been factory repaired since 12/31/43 and have had a 2531 tube installed. The 2530 tube does not have a grid cap connection. The 2531 tube will not directly replace the 2530 tube because of differences in wiring.

- (6) Carefully pull the two Amplifier Tubes out of their sockets and place aside.

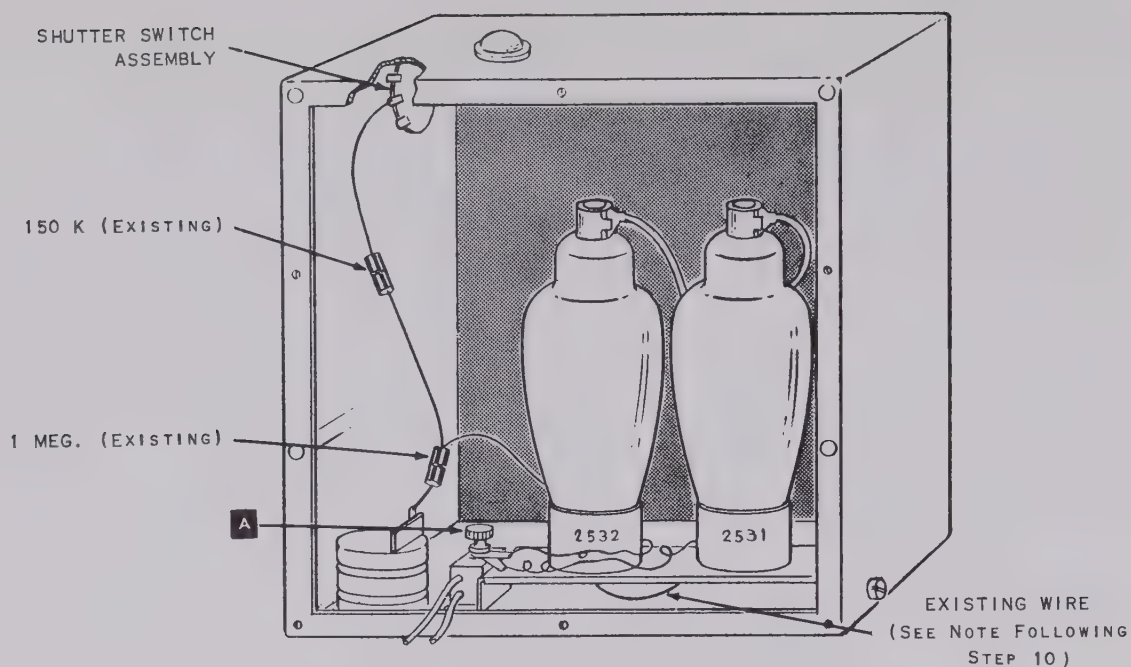


FIGURE 13. PHOTOMULTIPLIER RECEIVER COMPARTMENT WIRING

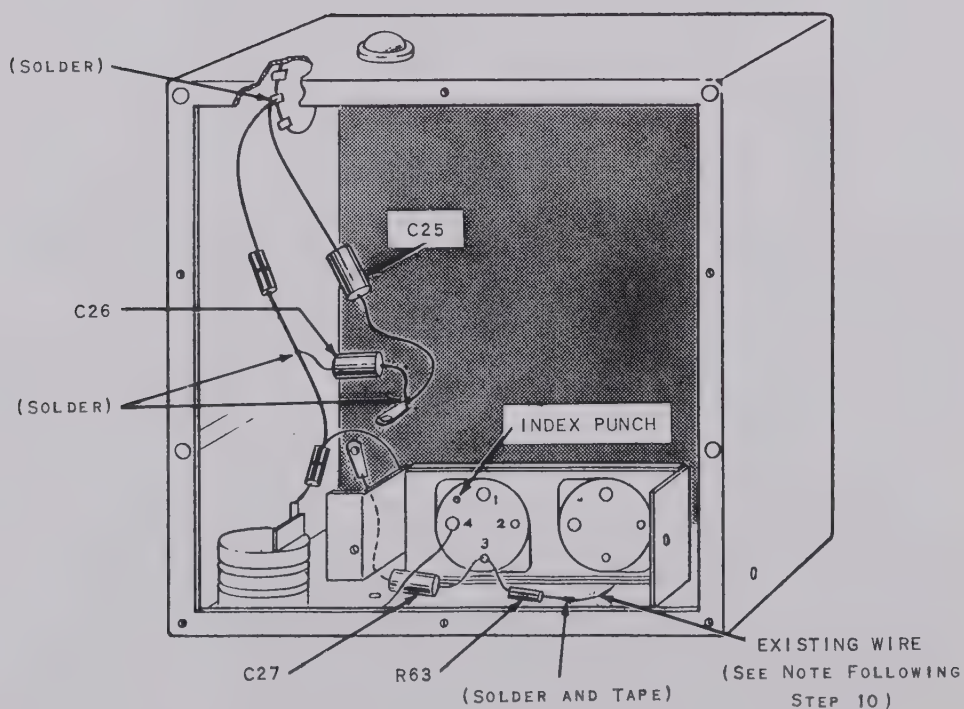


FIGURE 14. PHOTOMULTIPLIER RECEIVER COMPARTMENT, SHOWING MODIFIED WIRING

NOTE

In some instruments, the glass-envelope type 2531 Amplifier Tube has been replaced by a sub-miniature tube encased in metal. The glass-envelope tube and the metal-encased tube are interchangeable.

- (7) Remove screw A (Figure 15) attaching small chassis at rear of Photomultiplier Receiver Compartment.
- (8) Remove nut from screw B (Figure 15) attaching small chassis to bottom of Photomultiplier Receiver Compartment.
- (9) Raise small chassis (H, Figure 15) and lift front edge so that contacts on underside of tube sockets are accessible.
- (10) Remove existing wire from pin 3 of 2532 Tube socket. (See Figures 13 and 14.)

NOTE

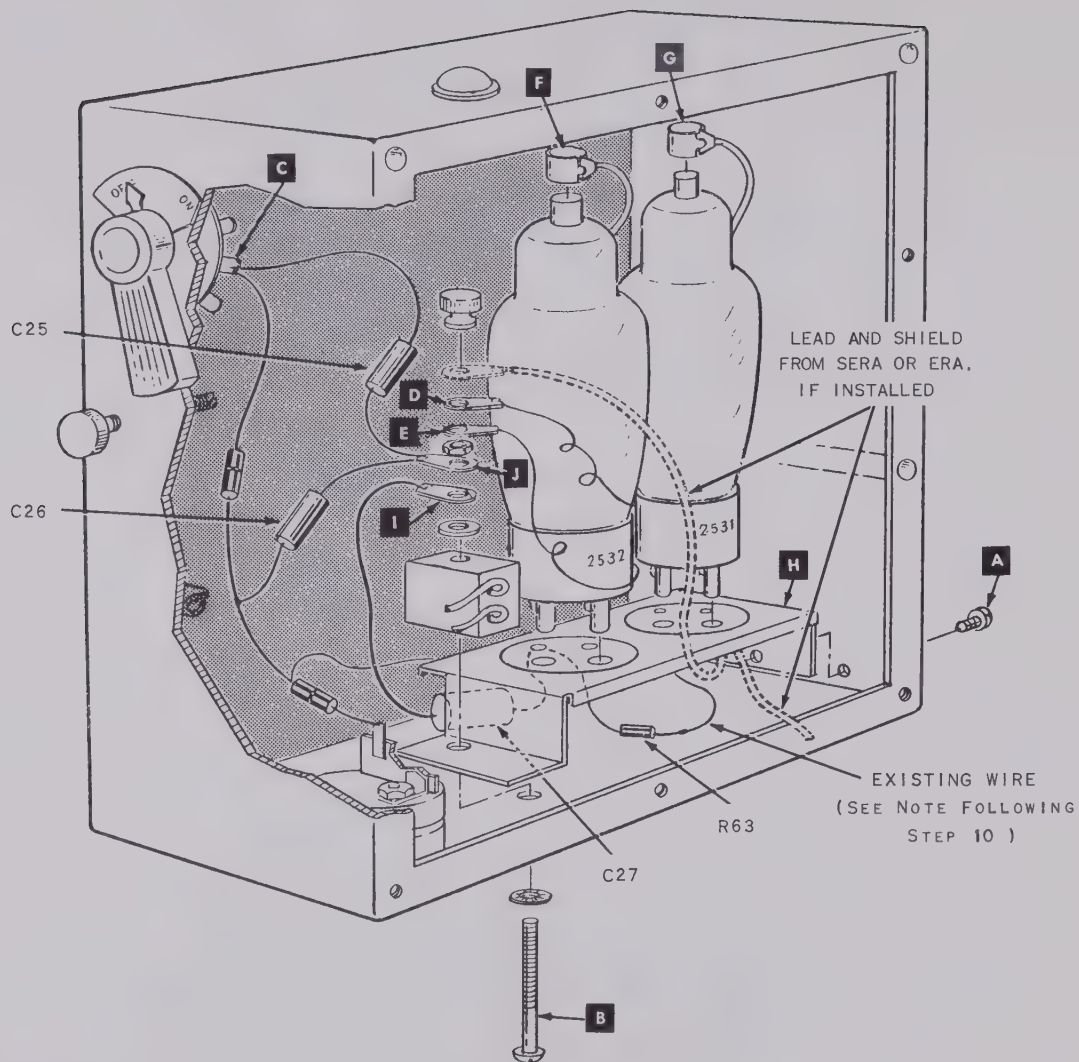
This wire may be colored yellow, brown, slate or orange.

- (11) Connect and solder one lead of 1000 ohm resistor (R63), supplied, to pin 3 of 2532 Tube socket. (See Figure 15.)
- (12) Connect and solder other lead of R63 to loose end of wire removed in (10) above. Tape connection.
- (13) Connect and solder one lead of .1 mfd capacitor (C27), supplied, to pin 3 of 2532 Tube socket. (See Figure 15.)

NOTE

Shorten lead as necessary so that C27 may be positioned as indicated in Figure 15.

- (14) Replace small chassis in original position, and replace attaching screws A and B removed in (7) and (8) above.
- (15) Replace bakelite block and nut on screw B.
- (16) Place solder lug (I, Figure 15), supplied, on screw B. Solder loose lead of C27 to this lug.
- (17) Solder one lead of .1 mfd capacitor (C25), supplied, to center terminal on inside of Shutter Switch. (See C, Figure 15.)



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- (18) Connect and solder one lead of .1 mfd capacitor (C26), supplied, to lead between existing 150K ohm resistor and 1 meg resistor. (See Figure 13.) Correct method connecting C26 is indicated in Figure 15.
- (19) Place solder lug (J, Figure 15), supplied, on screw B. Solder loose leads from C25 (Step 17) and C26 (Step 18), to this lug.

NOTE

Position capacitors C25 and C26 inside Photomultiplier Receiver Compartment so that they will not interfere with desiccant container attached inside end cover plate when replaced.

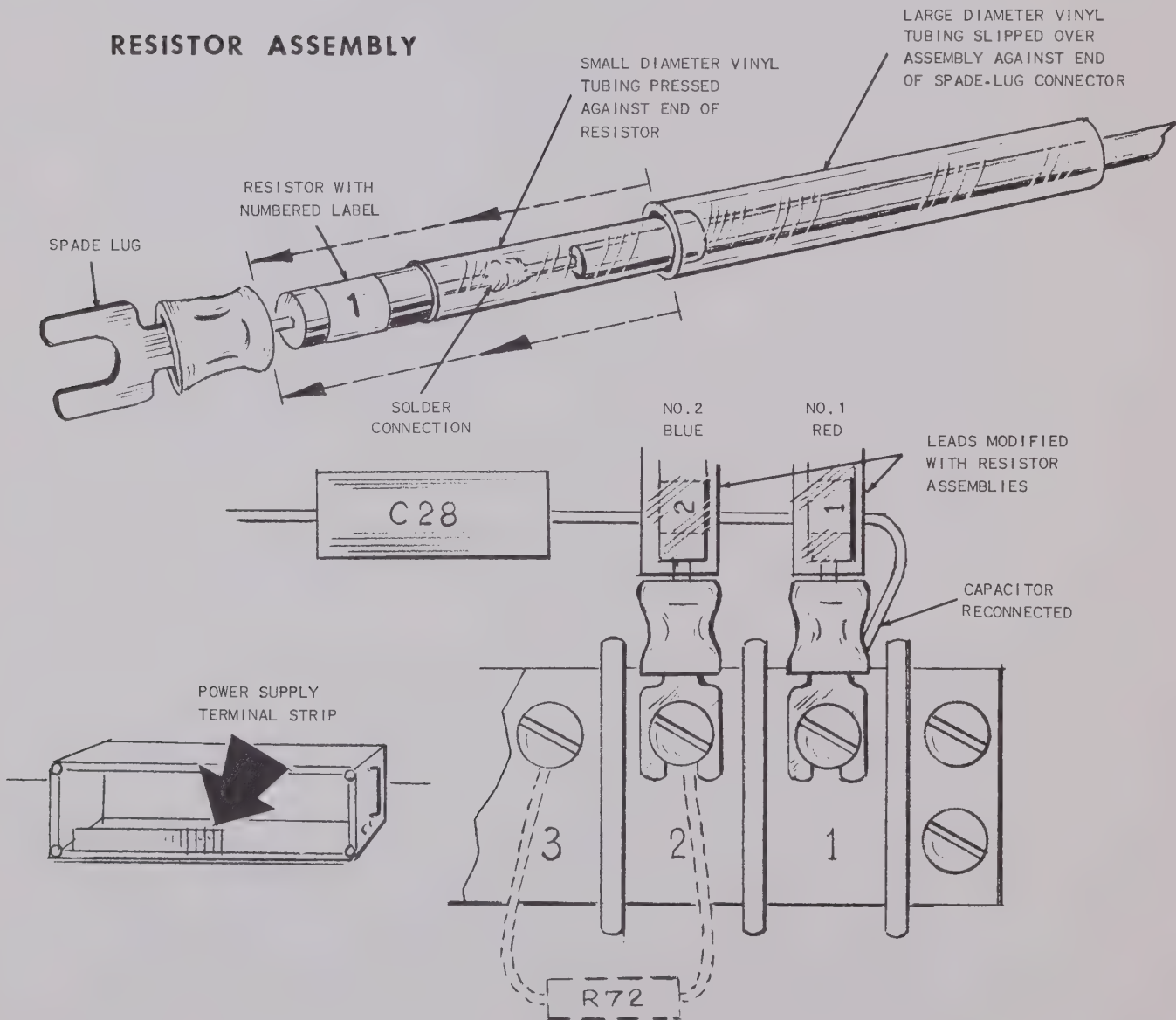
- (20) Replace knurled nut on screw B.
- (21) Replace end cover plate on Photomultiplier Receiver Compartment.
- (22) Attach Receiver Compartment and Cell Compartment to instrument.
- (23) Connecting Resistor Assemblies to Photomultiplier Cable Leads:

After completing modifications on Photomultiplier Receiver Compartment, connect Resistor Assemblies 45059 and 45061 to leads No. 1 and 2 on the Power Supply Terminal Strip. These assemblies are furnished with the Power Supply. Note that numbered labels on the resistors correspond to the leads to which they are to be connected.

- a. Disconnect No. 1 (red) lead and No. 2 (blue) lead from the Power Supply Terminal Strip. This will disconnect one lead of capacitor C28 from Terminal No. 1. C-28 is reconnected when the leads are replaced.
- b. Cut ring lugs from leads No. 1 and No. 2 and strip back insulation on both leads about 1/2-inch from ends.
- c. Two pieces each of No. 7 and No. 12 clear Vinyl tubing are supplied. Slip one piece of No. 7 and one piece of No. 12 over each of the two leads.
- d. Then solder resistor assembly No. 45059 (.24 meg, color coded Red-Yellow-Yellow) to lead No. 1. Slip small-diameter (No. 12) Vinyl tubing over solder connection and against end of resistor. Follow by working large-diameter (No. 7) Vinyl tubing over smaller tubing and resistor, butting end of tubing against spade-lug connection. Be careful not to snag edge of resistor label with tubing.

- e. Connect spade lug of No. 1 resistor assembly to Power Supply terminal No. 1, reconnecting the C28 capacitor.
- f. Assemble the No. 45061 resistor assembly (51,000 ohms, color coded Green-Brown-Orange) to lead No. 2 in the same manner in which No. 45059 assembly was connected to lead No. 1.
- g. Connect spade lug of the No. 2 assembly to Power Supply terminal No. 2. If resistor R-72 was connected to terminal 2, it should be reconnected at this time.

RESISTOR ASSEMBLY



SECTION 2G

2G. INSTALLATION OF GROUP ASSEMBLY SPECTROPHOTOMETER WITH PHOTOMULTIPLIER AND 115 OR 230 VOLT POWER SUPPLY

The DU Power Supply may be positioned conveniently behind the DU Spectrophotometer, as indicated in Figure 2. This location allows easy access to the Power Supply controls. As considerable heat is generated by the Power Supply, place the unit in such a position that the flow of air is not restricted.

The power cord is a three-conductor cable, provided with a three-pronged plug. A special adaptor is provided for use when the electrical outlet is not provided with a third (ground) contact. When using the adaptor, connect the pig-tail lead to a good earth ground to insure non-hazardous operation of the Power Supply.

To attach the Power Supply to the DU Monochromator unit, follow the procedure outlined below:

- (1) Invert Power Supply unit on two padded blocks.
- (2) Remove Bottom Cover Plate from Power Supply unit.
- (3) Feed the three cables attached to the DU through the three grommets in right end of Power Supply Unit.
- (4) Connect the leads of these three cables to corresponding numbered terminals of Power Supply terminal strip as shown in Figure 8A.

NOTE

Connect the Black (Gnd) leads of the cables to the "O" (Ground) terminal.

- (5) Replace Bottom Cover Plate on Power Supply unit, and turn right side up.
- (6) Connect Tungsten Lamp leads to terminals on right end of Power Supply.
- (7) If Hydrogen Lamp or Mercury Lamp is to be used, plug connector on Lamp cable into socket on right end of Power Supply unit.

SECTION 2H

2H. INSTALLATION OF GROUP ASSEMBLY SPECTROPHOTOMETER WITH PHOTOTUBE AND 230 VOLT POWER SUPPLY

The DU Power Supply may be positioned behind the DU Spectrophotometer, as in Figure 2, a location which allows easy access to the Power Supply controls. As considerable heat is generated by the Power Supply, place the unit so that the flow of air is not restricted.

The power cord is a three-conductor cable fitted with a three-pronged plug. A special adaptor is provided for use when the electrical outlet does not include a third (ground) contact. When using the adaptor, connect the pigtail lead to a good earth ground to insure nonhazardous operation of the Power Supply.

To attach the Power Supply to the DU Monochromator unit, follow the procedure outlined below:

- (1) Invert Power Supply unit on two padded blocks.
- (2) Remove Bottom Cover Plate from Power Supply unit.
- (3) Feed the cable attached to the DU through the grommet in the left end of the Power Supply Unit.
- (4) Connect the leads of this cable to corresponding numbered terminals of Power Supply terminal strip as shown in Fig. 4.

NOTE

Connect the Black (Gnd) leads of the
cables to the "0" (Ground) terminal.

- (5) Replace Bottom Cover Plate on Power Supply unit, and turn right side up.
- (6) Connect Tungsten Lamp leads to terminals on right end of Power Supply.
- (7) If Hydrogen Lamp or Mercury Lamp is to be used, plug connector on Lamp cable into socket on right end of Power Supply Unit.

SECTION 3

3. Service and Maintenance

3.1 General

The BECKMAN DU Power Supply requires no periodic maintenance to keep the unit operating properly. Considerable heat is produced by the unit, therefore it is essential that free circulation of air be permitted.

3.2 Replacement of Electronic Components

Electronic components of the DU Power Supply may be replaced by a qualified technician, and may be ordered through your BECKMAN Dealer. Descriptions of the replacement parts, and the BECKMAN Part Numbers, are given in the Replacement Parts List included in this Instruction Manual.

To check or replace tubes in the Power Supply, loosen the set-screws on the four control knobs and remove the knobs; take out four screws attaching the perforated metal cover at the rear of the instrument, and remove the metal cover. Other electronic components are accessible by removing the Bottom Cover Plate of the Power Supply.

3.3 Trouble-Shooting

Malfunctions of the Power Supply may be localized in the circuit by means of the Trouble-Shooting Charts in this Instruction Manual. These charts indicate in many cases corrective action to be taken; operation difficulties not specifically noted may be localized by following the checking procedures outlined, and a qualified technician will be able to pin-point and correct the trouble by checking the circuit diagram in this manual.

If operation difficulties are encountered which cannot be remedied, or if no qualified service personnel are available, contact your BECKMAN Dealer or Service Representative.

3.4 Tungsten Lamp Intensity

The Tungsten Lamp circuit of the Power Supply provides optimum light intensity with relation to reasonable life expectancy of the Lamp. However, if maximum light intensity is desired, it can be achieved by shunting the R83 resistor in the Tungsten Lamp circuit. Doing this will result in shortening the operating life of the Tungsten Lamp by as much as 80%. To shunt the resistor, solder a 5-inch length of No. 14 copper wire between Terminal 4 of Transformer T2 and the Tungsten Lamp terminal to which R83 is connected. The shunt parallels R83, and the circuit may be restored to normal operation, if desired, by clipping the shunt from its connections.

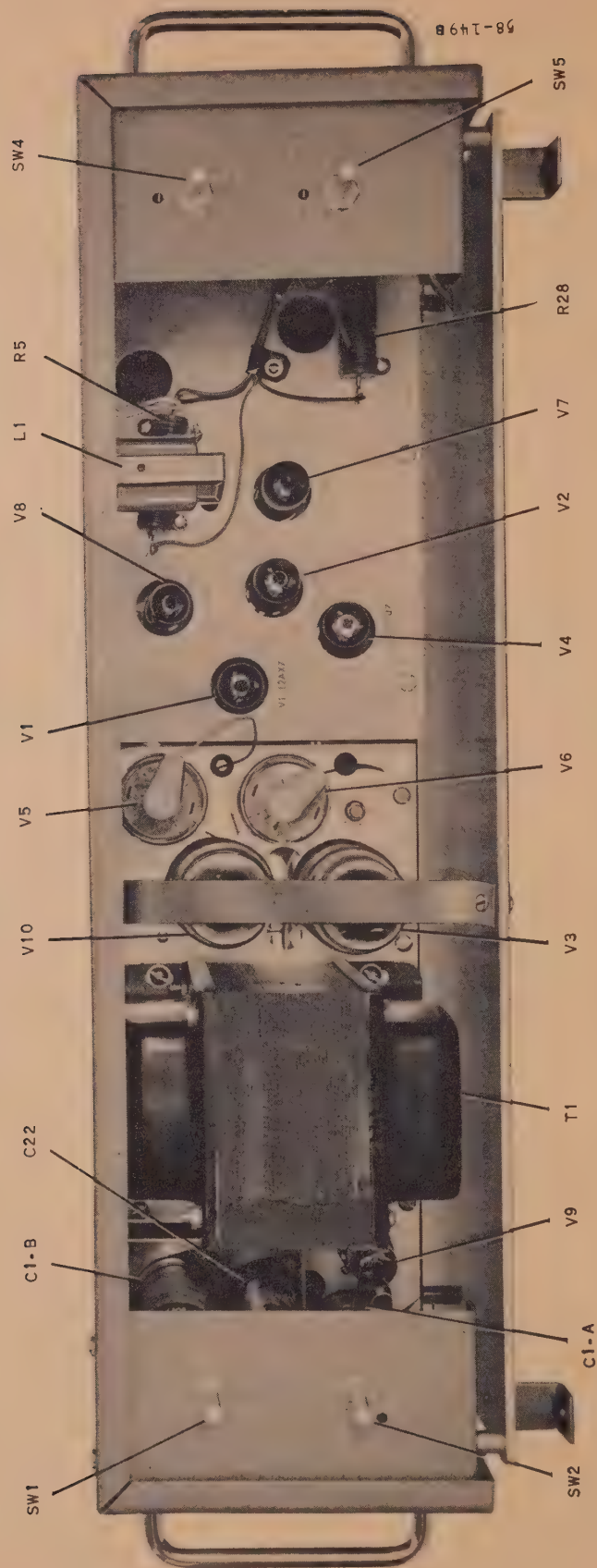
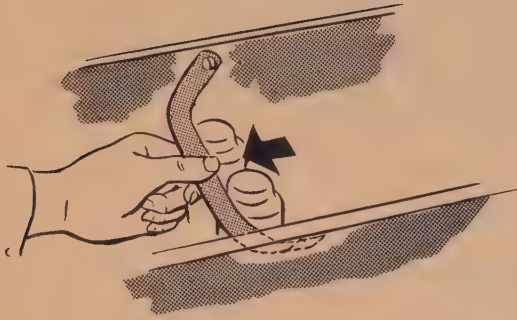


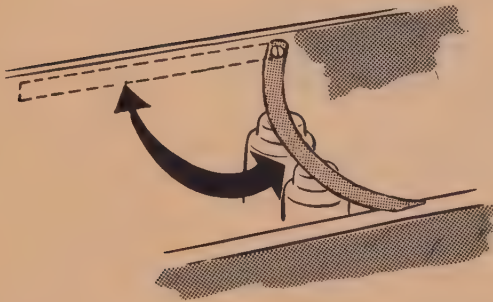
FIGURE 16. TOP VIEW, COVER REMOVED

Removal of Tube Retainer from Tubes V3 And V10



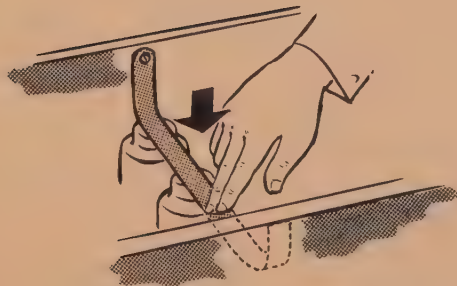
STEP 1

To remove tube retainer, grasp center of metal strap and pull gently to one side as indicated in drawing. Be careful that free end of retainer strap does not rub against cable clamped to inside of instrument side panel.



STEP 2

In open position, tube retainer rests flat against instrument side panel. To replace retainer over tubes, swing metal strap on pivoting bolt until strap is located transversely across cabinet and directly over tops of tubes.



STEP 3

Clamp tube retainer in place by pressing metal strap downward with fingertips until free edge of strap snaps under overhang of instrument side panel. This applies sufficient pressure to hold tubes securely in place.

3.5 DU Power Supply Trouble Shooting Charts

The Trouble-Shooting Charts on the following pages will be helpful in isolating and correcting most operating difficulties which may be encountered. Chart I encompasses operation of the entire Power Supply, while Chart II is confined to the regulator circuit. NOTE: Disregard references to following circuit components; C35, R87, R88, R89, V11 and V12.

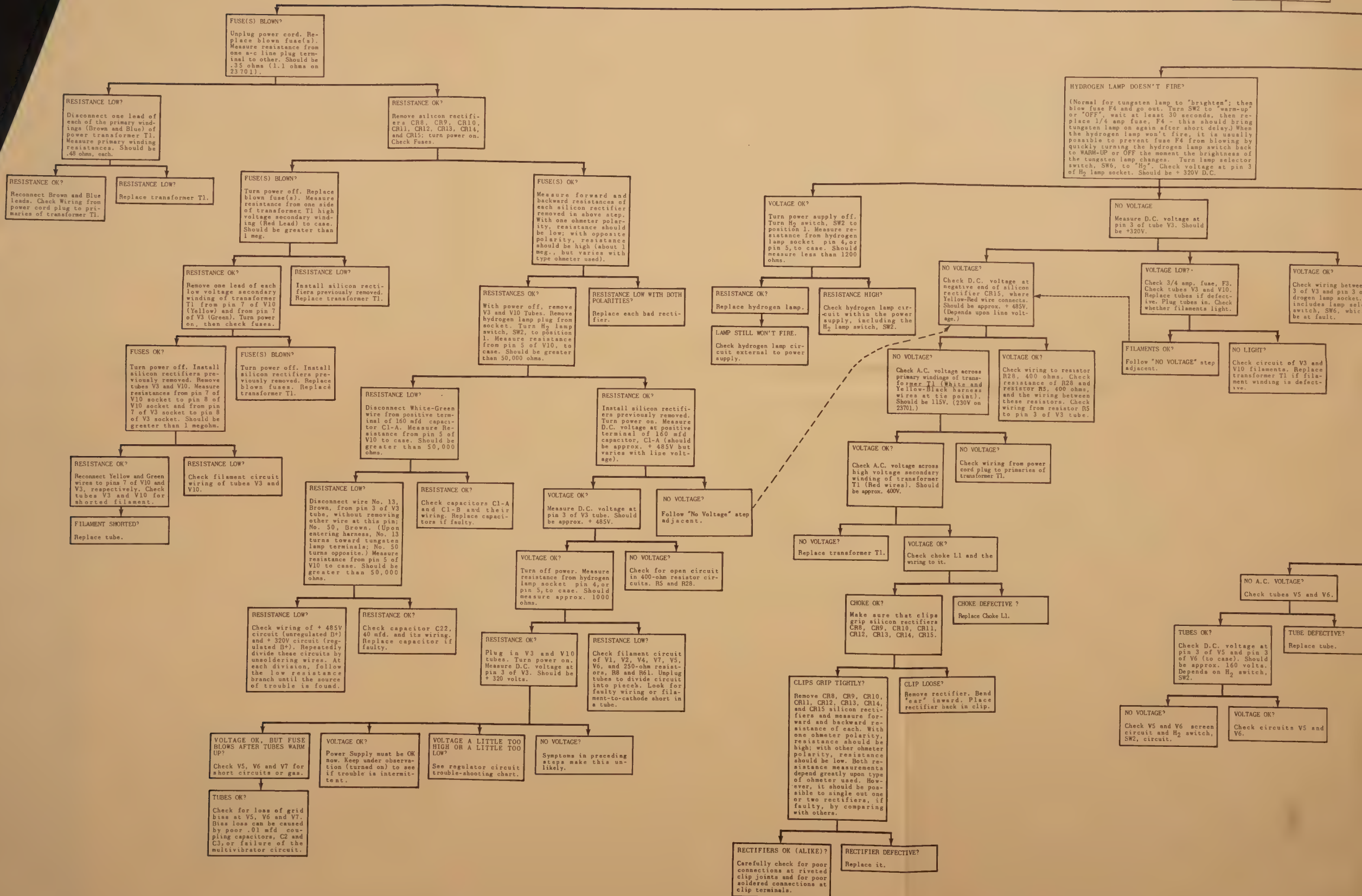
WARNING

DANGEROUSLY HIGH VOLTAGES ARE DEVELOPED IN PORTIONS OF DU POWER SUPPLY CIRCUITY. EXERCISE CAUTION DURING TROUBLE SHOOTING OPERATIONS. DISCONNECT MAIN POWER CORD AND ALLOW A FULL TWO MINUTES TO ELAPSE BEFORE ATTEMPTING REMOVAL OF PROTECTIVE COVER OR SYSTEM COMPONENTS.

DU POWER SUPPLY TROUBLE-

FOR MODEL DU TROUBLES NOT CAUSED BY
POWER SUPPLY, SEE SECTION 2 OF MOD
INSTRUCTION MANUAL 305.

POWER SUPPLY CONNECTED
TO A-C LINE, POWER
SWITCH ON, BUT UNIT
WON'T OPERATE?
Check 5 ampere fuses, F1
and F2 (3 amp on 23701).



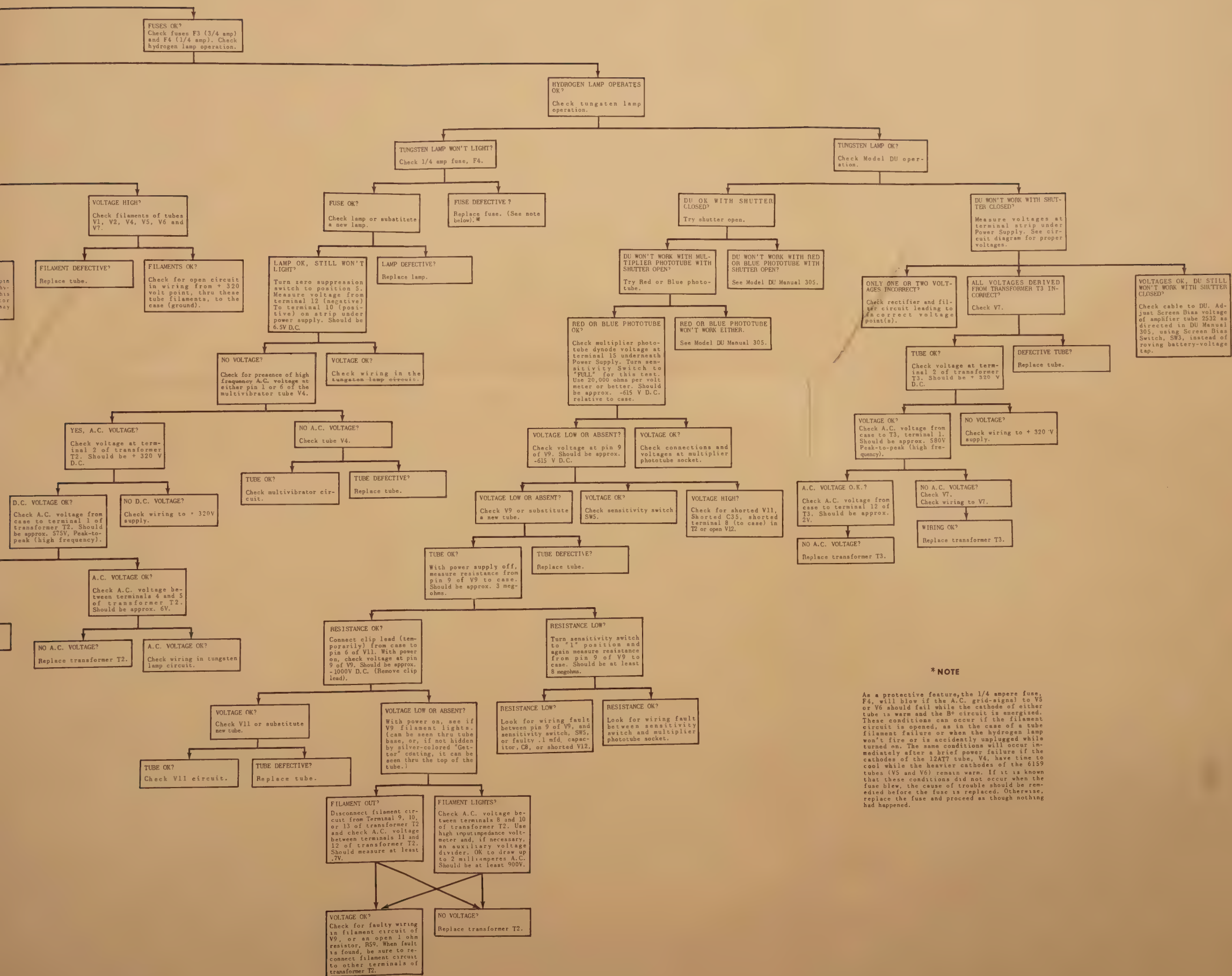
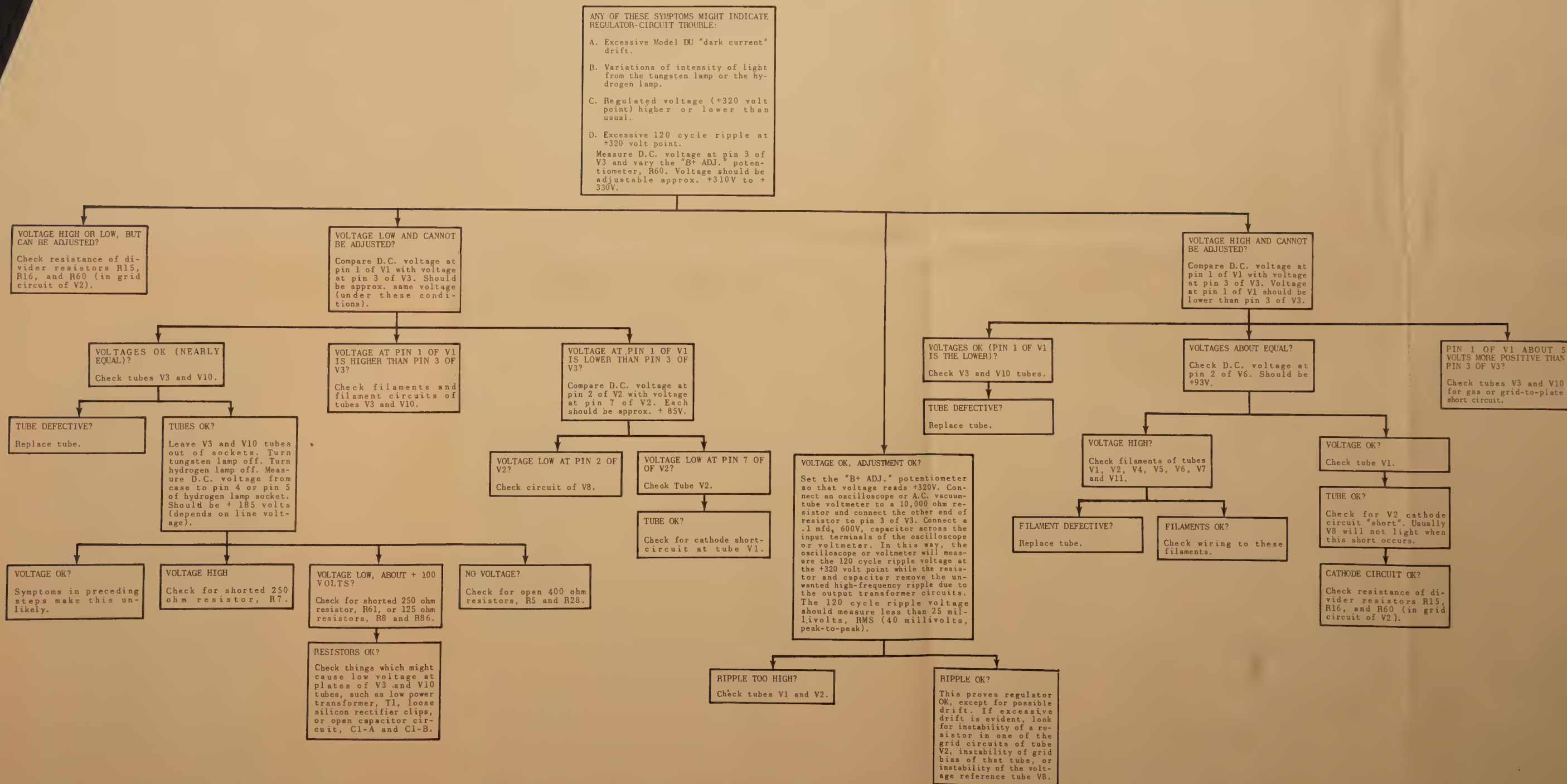


CHART II

REGULATOR-CIRCUIT TROUBLE-SHOOTING; MARGINAL OPERATION

IF SEVERE TROUBLE EXISTS, A FUSE WILL BLOW OR THE HYDROGEN LAMP WILL NOT FIRE. IN THESE INSTANCES, SEE TROUBLE-SHOOTING CHART I.



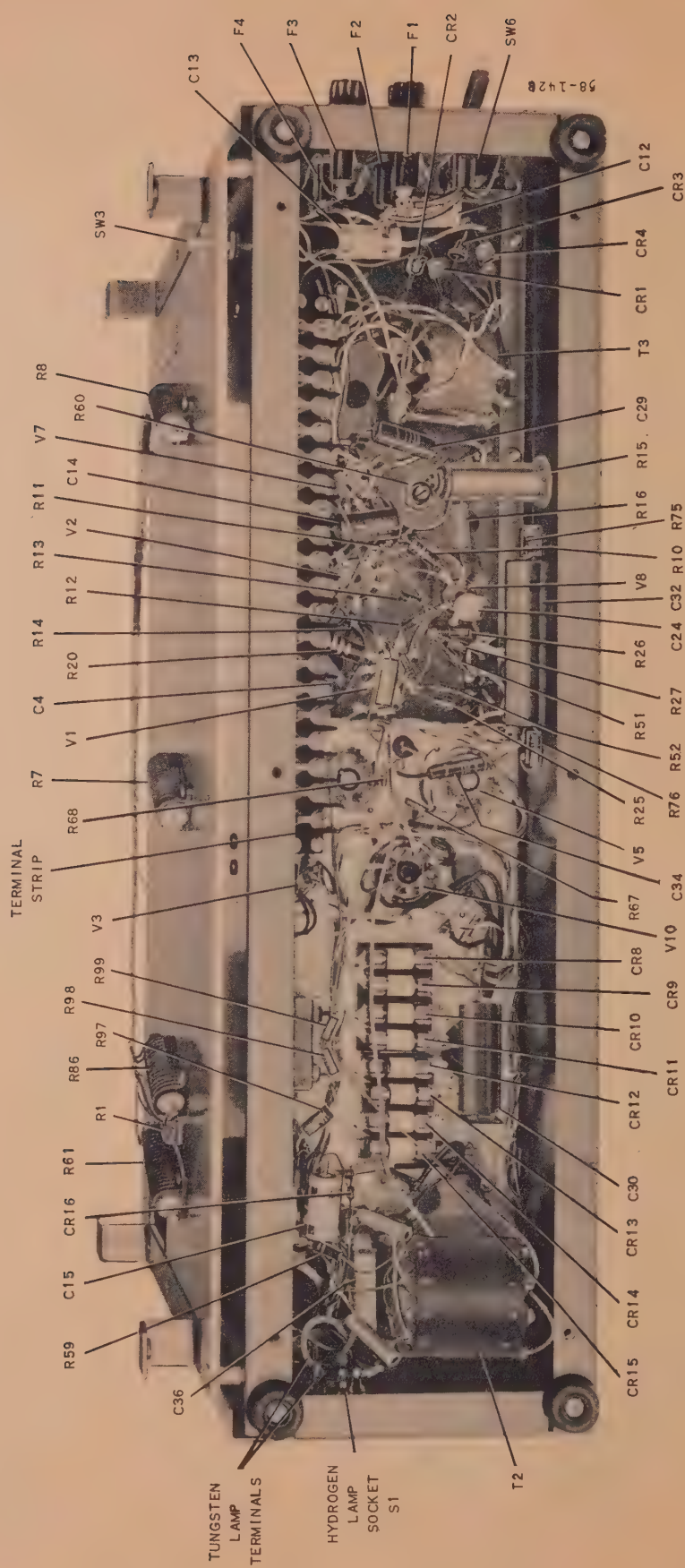


FIGURE 19. BOTTOM AND REAR VIEW, SHOWING ELECTRONIC COMPONENTS

Replacement Parts List

<u>ITEM</u>	<u>CIRCUIT REFERENCE</u>	<u>SEE FIGURE</u>	<u>DESCRIPTION</u>	<u>BECKMAN PART</u>
Capacitor	C1A, C1B	16	80-80 mfd, 350WV DC, Mallory FP227-6	23770
Capacitor	C2, C3	18, 21	.01 mfd, $\pm 20\%$, 500WV DC, Ceramic disc, general by- pass type	23752
Capacitor	C4, C5	18, 21	130 mmfd, $\pm 5\%$, 500WV DC Cornell-Dubilier Mica Type 22R	79182
Capacitor	C6, C7	18, 21	390 mmfd, $\pm 10\%$, 600WV DC, Solar No. CD8WA-391K	24671
Capacitor	C8	18	0.1 mfd, $+20\%$ -10%, 1000WVDC, oil-filled paper steel case, Mallory CB1002	23762
Capacitor	C9, C10, C11	18, 21	0.1 mfd, $\pm 20\%$, 100WV DC, Good-all 663UW10401	29935
Capacitor	C12, C13	18, 21	100 mfd, 12WV DC, Electro- lytic, Aerovox Bantam Type SRE	23751
Capacitor	C14	18, 21	1 mfd, $\pm 20\%$, 200WV DC, Metallized Paper, Aerovox Type P82	23763
Capacitor	C15	18, 21	See C12	23751
Capacitor	C16, C17, C18, C19	4	.001 mfd, $\pm 20\%$, 600WV DC, Fast A6436FJ	43104
Capacitor	C20	4	.1 mfd, 100WV DC, Good-all 663UW10401	29935
Capacitor	C21	4	500 mfd, 6WV DC, Elec- trolytic, Sprague Type D1103	23718
Capacitor	C22	16	40 mfd, 500 WV DC, Mallory FP177	23772
Capacitor	C23	22	.1 mfd, $\pm 10\%$, 100WV DC, Good-all 663UW10401	29935

<u>ITEM</u>	<u>CIRCUIT REFERENCE</u>	<u>SEE FIGURE</u>	<u>DESCRIPTION</u>	<u>BECKMAN PART</u>
Capacitor	C24	18, 21	See C2	23752
Capacitor	C25, C26	14	0.1 mfd, $\pm 20\%$, 200WV DC, Aerovox Type P82	17784
Capacitor	C28	8A, 9A	.002 mfd, 600V $\pm 20\%$ Fast No. A6591FJ	23797
Capacitor	C29	19, 21	.047 mfd, 600V $\pm 20\%$ Sprague 73P47306	15029
Capacitor	C30	19	150 mfd, 150WV DC, Mallory TC495	29680
Capacitor	C32	16	20 mfd, 600WV DC, Aerovox Type PRS	24971
Capacitor	C33	18, 21	.022 mfd, $\pm 20\%$, 400V Good-all 663UW 22304	99200
Capacitor	C34	19	.0047 mfd, Molded Paper 600V, Sprague No. 73P47026	15023
Capacitor	C36		250 mmfd, $\pm 10\%$, 2500 WV DC Mica. Sangamo Type HT-5325	79170
Choke	L1	16	.06 Henry $\pm 10\%$ at 7V, 2.0 ohms, 2.5 amp. peak, 0.85 amp RMS NYT Electronics No. 7590	28947
Diode	CR1, CR2, CR3, CR4	19, 21	GE1N91	17563
Diode	CR5, CR6	18	Type 1N34A Pacific Semi-Conductor	99042
Diode	CR7	18	Sylvania 1N38A	99528
Diode	CR8, CR9, CR10, CR11, CR12, CR13, CR14, CR15	18, 19	Rectifier, Silicon, 500 ma, Sarkes Tarzian Type M-500 (Jetec 1N1084)	23744
Diode	CR16	18, 19	See CR5	99042
Insulator	CR1, CR4	19	Must be placed over diodes CR1 and CR4 only	14596

<u>ITEM</u>	<u>REFERENCE</u>	<u>FIGURE</u>	<u>DESCRIPTION</u>	<u>BECKMAN PART</u>
Fuse	F1, F2	18, 19	5 amp, LF Type 3AG 311005 125 volts	2232
	(For 23701 only, 3 amp, 250 3AG 312003)		volts, Littelfuse Type	516
Fuse	F3	19	.75 amp, Littelfuse Type 3AG U/L	29623
Fuse	F4	19	250V, 1/4 amp., Littelfuse 312.250	99403
Potentiometer	R60	18, 19	5000 ohms, Screw-Driver Slot, 1/8 Shaft, 3/8 Bushing, Clarostat No. 43-5000	7520
Resistor	R1	19, 21	4000 ohms $\pm 10\%$, 25 watts Dale Products Type B-25	79116

NOTE If R1 is not on Radiating Panel
as above, it will be found in
the bottom of the supply next
to C32 as listed below

Resistor	R1	19, 20	4000 ohms, $\pm 10\%$, 25 watts Ohmite Type 0211	2198
Resistor	R2	20	4000 ohms $\pm 3\%$, 5W, Dale Prod. Type RS-5	20481
Resistor	R3, R4	20	500 ohms, $\pm 1\%$, 3 watts, Sage S3W or equivalent	23375
Resistor	R5	16, 20	400 ohms, $\pm 10\%$, 50 watts Dale Products Type B50	22433
Resistor	R8		125 ohms, $\pm 10\%$, 50-watts, Dale B-50	99212
Resistor	R7	19	250 ohms, $\pm 10\%$, Dale Products, Type B-50	23747
Resistor	R10	19, 21	82,000 ohms, $\pm 5\%$, 2 watt, Allen Bradley Comp. Type HB	20354
Resistor	R11	18, 19, 21	3.6 meg, $\pm 5\%$, 1/2-watt, Allen Bradley Type EB	15090

<u>ITEM</u>	<u>CIRCUIT REFERENCE</u>	<u>SEE FIGURE</u>	<u>DESCRIPTION</u>	<u>BECKMAN PART</u>
Resistor	R12	18, 19, 21	.15 meg, $\pm 5\%$, 1/2-watt, Allen Bradley Type EB	15079
Resistor	R13	18, 19, 21	.82 meg, 1/2W $\pm 5\%$ AB-EB	1390
Resistor	R14	18, 19, 21	See R11	15090
Resistor	R15	18, 19	.1 meg, $\pm 1\%$, 2 watt, Cinema Type B14JE or equivalent	99263
Resistor	R16	19, 21	34,800 ohms, $\pm 1\%$, 1W, Cinema SW1BJE	99562
Resistor	R17	18, 21	240,000 ohms, No. 1 .5W, $\pm 5\%$, AB No. EB	41150
Resistor	R18	18, 21	.1 meg., $\pm 1\%$, Deposited Carbon, Commercial Grade 1/2 W., Dale Products Type CC-1/2	22434
Resistor	R19, R20	18, 21	25,000 ohms, $\pm 1\%$, 3-watts, Dalohm Type RS-2	79169
Resistor	R21	18, 21	See R18	22434
Resistor	R22, R23, R24	18, 21	See R17	41150
Resistor	R25	19, 21	.75 meg. $\pm 5\%$, 1/2-watt, Allen Bradley, Type EB	15088
Resistor	R26, R27	19, 21	47,000 ohms, $\pm 5\%$, 1/2-watt Allen Bradley Type EB	15064
Resistor	R28	16	See R5	22433
Resistor	R30, R31, R32, R33, R34	18, 20	10,000 ohms, $\pm 5\%$, 1/2-watt Allen Bradley Type EB	15052
Resistor	R35, R36, R37, R38, R39	20	Loop Resistance Wire	23713
Resistor	R40, R41, R42, R43, R44	20	620 ohms, $\pm 5\%$, 1/2-watt Allen Bradley Type EB	20411

<u>ITEM</u>	<u>CIRCUIT REFERENCE</u>	<u>SEE FIGURE</u>	<u>DESCRIPTION</u>	<u>BECKMAN PART</u>
Resistor	R45	4	1 meg, 1/2-watt, $\pm 5\%$ Allen Bradley Type EB	41151
Resistor	R51, R52	19, 21	See R26	15064
Resistor	R53	4	5.1 meg, $\pm 5\%$, 1/2-watt Allen Bradley Type EB	10624
Resistor	R55	22	1.5 meg, .5W, $\pm 5\%$ Allen Bradley Type EB	13193
Resistor	R56		2 meg, .5W, 5% Composition, Allen Bradley Type EB	2209
Resistor	R57 R58		2.4 meg, .5W, 5% Composition, Allen Bradley Type EB	12480
Resistor	R59		.68 ohm, $\pm 10\%$, 1/2W IRC Type BW1/2	99915
Resistor	R61	19	See R7	23747
Resistor	R63	14	1000 ohms, $\pm 10\%$, 1/2-watt Allen Bradley Type EB	8076
Resistor	R67, R68	19, 22	See R30	15052
Resistor	R72		22 meg, Allen Bradley EB	8852
Resistor	R73	20	.47 meg, $\pm 10\%$, 2 watt, Allen Bradley Type HB	99153
Resistor	R75	16, 20	91 ohms, $\pm 5\%$, 1 watt, Allen Bradley Type GB	16416
Resistor	R76	16, 20	.33 meg, $\pm 10\%$, 2 watt, Allen Bradley Type HB	99172
Resistor	R77		1.3 meg, .5W, $\pm 5\%$ Allen Bradley Type EB	99238
Resistor	R78	22	1 meg, .5W, $\pm 5\%$, Allen Bradley Type EB	41151
Resistor	R79, R80		.82 meg .5W, $\pm 5\%$ Allen Bradley Type EB	1390

<u>ITEM</u>	<u>CIRCUIT REFERENCE</u>	<u>SEE FIGURE</u>	<u>DESCRIPTION</u>	<u>BECKMAN PART</u>
Resistor	R81		.68 meg .5W, $\pm 5\%$ Allen Bradley Type EB	1554
Resistor	R82	20	10,000 ohms, $\pm 5\%$, 1/2-watt Allen Bradley Type EB	15052
Resistor	R83	20	.1 ohm (Special)	28859
Resistor	R84	21	10,000 ohms, 1/2-watt, $\pm 5\%$ Allen Bradley Type EB	15052
Resistor	R85	21	12 meg. 1/2-watt, $\pm 5\%$ Allen Bradley, Type EB	99336
Resistor	R86	19, 20	125 ohms, $\pm 10\%$, 50 watts Dale B-50	99212
Resistor	R91		51,000 ohms, (Special)	45061
Resistor	R92		.24 meg, (Special)	45059
Resistor	R93, R94		91 ohms, 1/2-watt, $\pm 5\%$ Allen Bradley Type EB9105	16634
Resistor	R95, R96		20,000 ohms, 10-watt P. R. Mallory Type 1HJ	16831
Resistor	R97		Selected	
Resistor	R98, R99		4.7 meg. $\pm 5\%$, 2 watt Allen Bradley Type HB	79191
Switch	SW1	16, 20	Power Switch Assembly	23746
Switch	SW2	16, 20	H ₂ Lamp Switch Assembly	45182
Switch	SW3	19, 20	Screen Switch Assembly	45644
Switch	SW4	16, 20	Zero Suppression Switch Assembly	23720

<u>ITEM</u>	<u>CIRCUIT REFERENCE</u>	<u>SEE FIGURE</u>	<u>DESCRIPTION</u>	<u>BECKMAN PART</u>
Switch	SW5	16, 20	Sensitivity Switch Assembly	45645
Switch	SW6	19, 20	Lamp Selector Switch	23795
Transformer	T1	16, 20	Transformer, Power	28820
Transformer	T2	19, 20	Transformer, Output	28736
Transformer	T3	19, 20	Transformer, Output	28735
Vacuum Tube	V1, V2	16, 20	12AX7	15093
Vacuum Tube	V3	16, 20	Chatham 6336	99127
Vacuum Tube	V4	16, 20	12AU7	12015
Vacuum Tube	V5, V6	16, 20	6159	23743
Vacuum Tube	V7	16, 20	RCA 12BH7A	23742
Vacuum Tube	V8	16, 20	85A2	20820
Vacuum Tube	V9	16, 20	RCA 1V2	23730
Vacuum Tube	V10	16, 20	Chatham 6336	99127

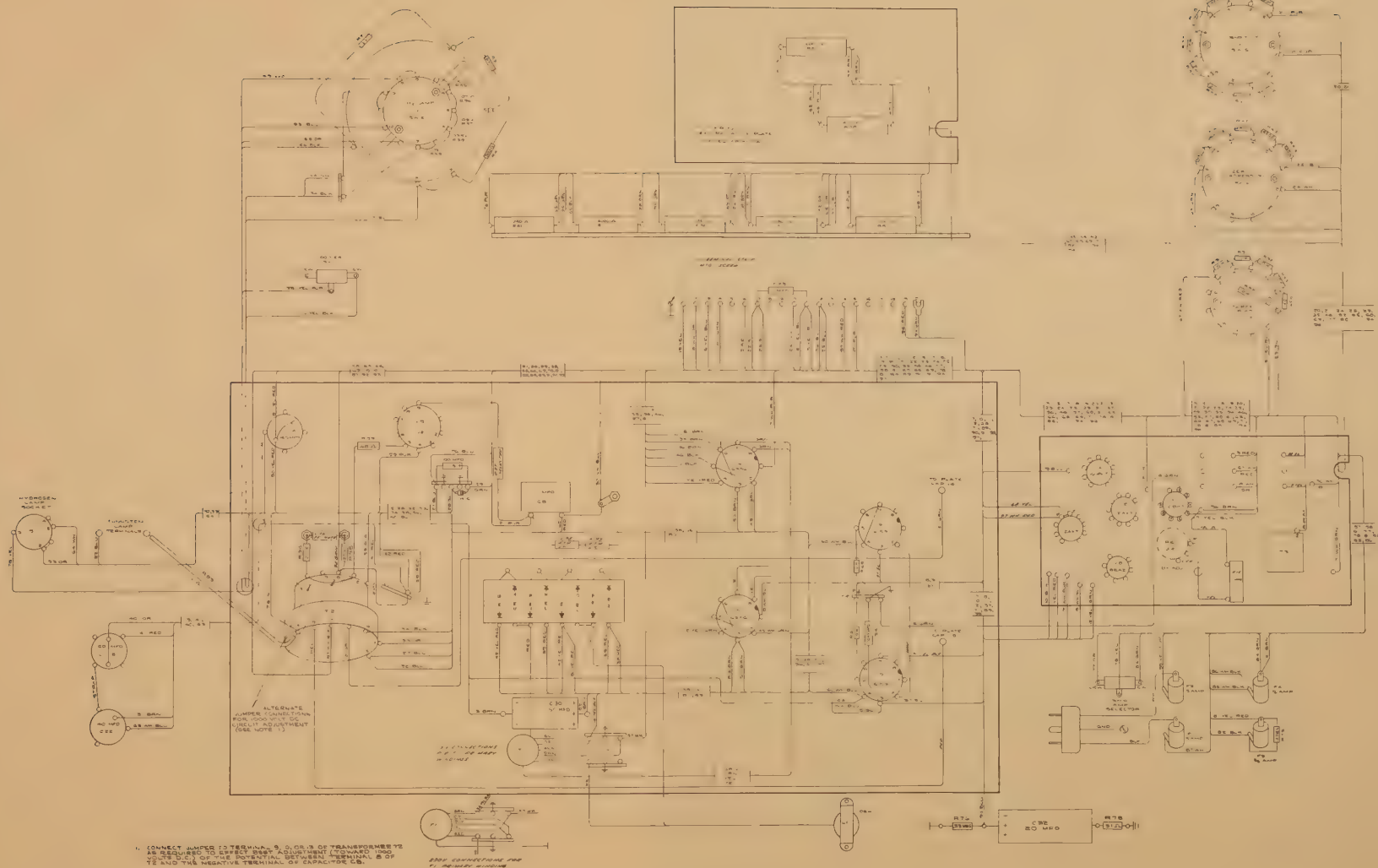


FIGURE 20. PICTORIAL WIRING DIAGRAM

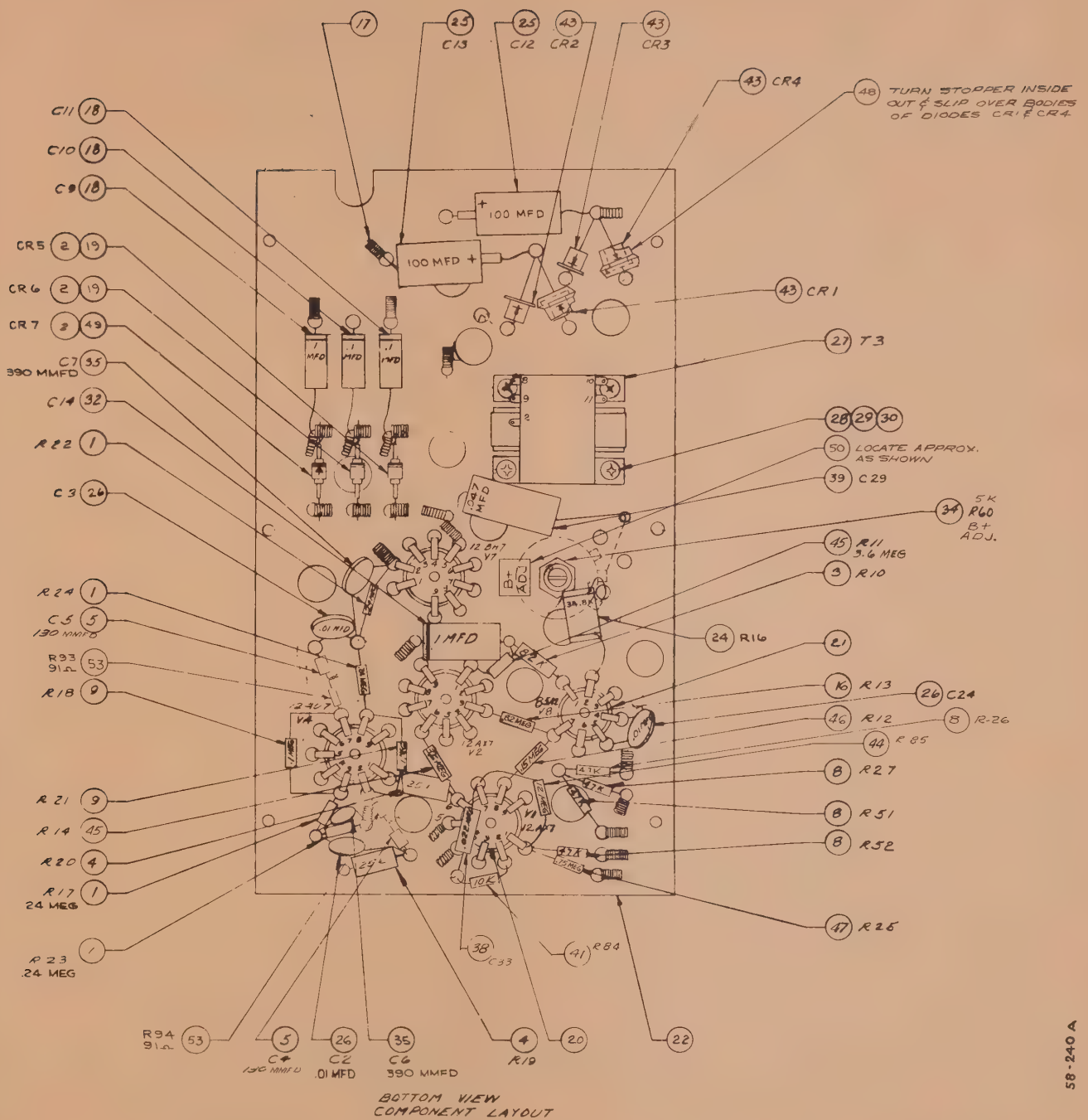


FIGURE 21. AMPLIFIER BOARD PICTORIAL WIRING DIAGRAM

MP MASTER



MA34167